ENGINEERING NEWS

AN OVERHEAD BRIDGE is proposed at East Albany, (Greenbush) N. Y., over 19 tracks centering there, which are spread out over a distance of 800 ft. on the main street. Only 6 of these tracks have ever been authorized by village ordinance. More than 75 tracks converge on the 19 tracks in question, and 360 regular trains per day, with a constant succession of switch engines, are running over them. *No flagmen at all are employed there*, if the newspaper statements are correct, which appears almost incredible. The population of the village is not large, but still there is a great deal of travel over the tracks, and the demand is plainly reasonable. That such conditions should exist is barbarous, and will seem incredible fifty years from now.

THE MICHIGAN CENTRAL is using soft steel this year for its 44-in. splices, the bolts being spaced 6, 9, and 9 ins., the same as for the past four years. The Harvey grip-thread bolt is used. These long splices have so far rendered excellent service, and continue to do so.

THE ORIGINAL WEST SHORE JOINT, 36 ins. long, 45 lbs. per pair, is also still rendering excellent service. The Hudson River Division track was laid in 1882, the Buffalo Division in October, 1883. The latter division is "single track" line, and these joints have been under continuous very heavy traffic ever since those dates, the engines being very heavy, viz., passenger 32 tons on 4 drivers, and freight 44 tons on 8 drivers. Examination of these joints shows that they are not bent or twisted at all, and show but small effect of "pounding" and "abrasion" at rail ends; on some of them, wear of any kind is hardly perceptible.

The General Superintendent, in reporting on them, stated:

Our experience with these angle plates in actual service is that they are first-class in every respect. We have never had an angle plate break under fair usage.

A PROPOSED LONDON SUBWAY, illustrated in the *Railway News*, is an exact copy of the proposed New York District Subway, illustrated in our issue of Jan. 2, 1886. The arrangement of all the detail of track, paving support, sewer, water, gas, and electric wire disposal, is identically the same. The use of "ferflax" in the partitions separating the passages for the trains is also another indication that the scheme is really American in its conception and is simply the rejected Broadway plan transferred to Holborn Circus. And it is by no means a bad plan.

THE GRAND CAÑON of the Colorado is in the hands of railway projectors, who propose, according to press accounts, to construct a road from a point near the Grand Junction in Western Colorado, through the Grand Cañon to some point on the California coast, probably San Diego. The road would be known as the Denver, Colorado Cañon & Pacific R. R., with $2,000,000 capital stock. The length of the railway would be about 1,050 miles, including the 200 miles through the Cañon. According to all accounts, railway construction through this gorge will be exceedingly difficult and exceedingly costly. It has only been traversed by white men three or four times, and only once without loss of life.

AN IMMENSE NEW OFFICE BUILDING, the largest in the world, is proposed at Nos. 5, 7, 9 and 11 Broadway, extending through to Greenwich St., covering an acre of ground. The plans have been prepared by GEO. EDWARD HARDING & Co. The facade on Broadway is to be of the modified Romanesque style, and is sixteen stories high. The lower four stories are to be of granite, and the rest of limestone. The front in Greenwich St. will be seventeen stories high, but not of so elaborate a design, and will be entirely of limestone.

The building will contain 950 offices, and will be the largest building in New York, and the largest office building in the world. The walls will be mainly of iron construction, and on account of the extreme height, the supporting columns will be of the Phœnix wrought-iron pattern. The estimated cost of the building is $2,225,000.

THE EIFFEL TOWER, in Paris, was formally opened to the public on March 31.

THE MEIGS ELEVATED RAILWAY CO., of Chicago, has deposited with the treasurer of that city $100,000 as a guarantee that the Lake St. road would be built. This was in accordance with the ordinance of Dec. 28 requiring them to make this deposit within 90 days. As a consequence, the West Division of Chicago expects to have an elevated road in operation within the next 15 months.

THE NORTH RIVER BRIDGE BILL has reached a third reading at Albany. This is the bill of Judge GREENE calling for a bridge with a pier or piers in the river, starting from Castle Point, in Hoboken, and landing near 13th St. on the New York side. Considerable opposition was developed, but a motion to refer the bill back to the Committee on Commerce and Navigation was defeated by a vote of 30 to 68.

PANAMA CANAL despatches, received to March 25, state that the Slaven Contracting Co. has ceased work and the Canal Co. will take charge of the plant. The Jacob Co. is still doing work. The Artique, Sondereger & Co. contract for work at Bohio has been rescinded, but it continues work at Culebra. The Société des Travaux Publics has resumed its contract, Baratoux, Letellier & Co. are at work at La Boca. The Eiffel Co. and Erzinger, Dephieux, Gaitier & Co. have received orders to stop work. Contracts generally are being rescinded and the Canal Co. is taking possession of the plant and work executed. Workmen to the number of 6,000 have been sent away and a like number await transportation. Empty houses along the line are being torn down and converted into fuel for cooking purposes by the workmen.

GRADE-CROSSINGS on the Pennsylvania R. R. in Philadelphia are to be removed at the expense of over $1,000,000 to the railway company; 19 crossings in all, mainly in Frankford, are included in the list; and the company notifies the city that if streets shall hereafter be opened across the tracks, the city must look out for the removal of grade-crossings.

ROCK ISLAND R. R. ENGINEERS started from Topeka, Kansas, on the announcement of the Oklahoma proclamation, to make the final survey for the extension of that road through the Indian Territory. The road is built to Pond Creek, 25 miles below the Cherokee strip, and construction will begin at that point. Fort Reno is expected to be the point aimed at by the engineer corps.

THE CITIZENS' WATER CO., OF DENVER, Col., was incorporated this week with $3,000,000 capital. The stockholders include DAVID H. MOFFAT, W. S. CHEESMAN, GEORGE W. KASSLER, the JEROME B. CHAFFEE estate, etc. In this party are ex-directors of the Denver Water Co. now controlled by the representatives of the widow of Col. ARCHER, of Reading, Pa. The retiring directors wished to enlarge the old works, but meeting with opposition they sold their stock to the present owners, and now propose to build and maintain a system of works more in accordance with their own views. The new projectors claim to control an ample water source and promise a larger and finer system of works than Denver might otherwise have had for a number of years. They talk of 60,000,000 galls. per day, instead of the present 12,000,000 galls., and a gravity system to supplant the present Holly pumps.

THE HERRESHOFF TORPEDO BOAT, under construction at Bristol, R. I., is fast nearing completion, and is expected to be ready for trial in May next. This boat is 137 ft. long, 14½ ft. beam, and 8 ft. depth of hold, with a draught of 3 ft. 7 ins. She is to carry a secondary battery of two 6-pounder rapid firing guns and the contract calls for a speed of 20 knots per hour on the official trial. The builders confidently expect a speed of 23 knots.

A BRIDGE AT ST. JOSEPH across the Missouri river is being again considered by the Chicago, St. Paul & Kansas City R. R. Co. It must now either bridge the river here or purchase expensive right of way through the city, and it is supposed that the company will prefer to bridge.

THE PROJECTED KANSAS CITY UNION DEPOT is an immense affair, the estimated cost of the ground and building being $3,774,000. The location suggested is on 2d St. near Grand Ave.

THE ROAD BILLS now before the Pennsylvania Legislature differ widely in their character. The last form taken is that of a resolution authorizing the Governor to appoint a commission of three members of the Senate and five members of the House to revise and consolidate the laws relating to the construction and improvement of public highways, which strikes us as a most excellent plan for "not doing it."

PHILADELPHIA STREETS ARE TO BE REPAVED wherever occupied by street-car tracks, at the expense of the railway companies, and the repaving is to be done with granite blocks. Seventeen presidents of companies have been formally ordered to pave under the ordinance of 1857, which makes it their duty to do so when requested by the proper official. But the question still open is whether the granite block provision can be enforced as a substitute for the present antiquated cobblestones.

THE WESTINGHOUSE AIR-BRAKE CO. has bought 600 acres of land at Wilmerding, near Pittsburg, Pa., and about 30 acres of this will be devoted to the air-brake manufactory. Accounts say that the foundry alone will cover four acres and 5,000 workmen will be employed. The Pittsburg Improvement Co. is reported to be ready to spend about $4,000,000 in all within the limits of the 600 acres in the shops and homes for workmen.

THE WASHINGTON OR MANHATTAN BRIDGE, over the Harlem river at Washington Heights, has been formally handed over to the Commissioners. The opening is delayed by trouble in obtaining legal possession of a piece of ground required for the east approach, for which the Ogden estate demands $112,000.

A MISSOURI GEOLOGICAL SURVEY is apparently about to be authorized by the Legislature of that State. No adequate survey of this character has ever been made in Missouri and no geological survey of any kind for years past.

THE NEWARK, N. J., WATER SUPPLY QUESTION has progressed to the extent of ordering the City Counsel to draw up a contract with the Lehigh Valley R. R. Co. This contract is to accord with the propositions, amendments, and alterations approved by the Common Council, and Mr. JACOBSEN, the Engineer of the Water Board, is to assist the counsel in formulating the details of the proposed contract.

THE MOST SERIOUS RAILWAY ACCIDENT of the week was the wrecking of a Baltimore & Ohio freight train by the collapse of a bridge near Cameron, W. Va., on April 1. The driver noticed that the bridge was on fire, but it was too late to stop the train; the engine got across in safety, but the bridge gave way under the train and 17 cars went down. The wreck caught fire and two men were burned to death; one man was injured.——On March 28, a passenger train, on the Ottumwa division of the Wabash Western, went through a bridge (or trestle) near Queen City, Mo., the piling having been damaged by fire. Two men were killed and 2 injured.——On March 31 a collision occurred between two sections of a freight train on the New York, Pennsylvania & Ohio near Jamestown, N. Y.; it was caused by the crew of one train not reading their orders carefully and disregarding the order to pass the other train at Lakewood.

A LANDSLIDE occurred on the Baltimore & Ohio at Pittsburg, Pa., April 2.——A break in the canal at Medina, N. Y., occurred March 30.——The Oakdale dam, near Modesto, Cal., is said to have been carried away by flood.

A DISASTROUS COLLISION on the Taku & Tientsin railway, in China, is reported to have occurred on March 30. Several persons are said to have been killed.

SOME FORM OF RAILWAY UP STORM KING mountain is proposed by some English capitalists, and we should judge would be a profitable venture. It is proposed to erect a lookout on the summit of Storm King to command an extensive view of the Hudson, both north and south, which it is justly claimed will in some respects eclipse any view of this kind in the world.

THE INTERSTATE RAILWAY ASSOCIATION will hold a meeting at Chicago on Tuesday, April 9, to complete the organization and formally instal Mr. ALDACE F. WALKER as Chairman.

THE CONSUL-GENERAL OF CHILE, in an advertisement in our columns to-day, offers a premium of 20,000 francs, or $4,000, to the successful competitor in a trial of flour milling machinery, which will take place in Santiago, Chile, in November next, under the auspices of an industrial society of that capital. Considering that Chile is the great wheat and flour exporting country of South America, that there are in that republic over 800 flour mills, and that the successful competitor will receive, not only a premium of $4,000, but in all probability an order to furnish the mills of the country with improved machinery, the offer is a tempting one to those engaged in the making of such machines.

DRAINING AND DITCHING is recommended by the *Pioneer Press* for the valley of the Red River in Minnesota and Dakota. It is figured that an area covering 2,000,000 acres is so deficient in natural drainage as to require artificial drainage. Of this rich soil only 500,000 acres are under cultivation owing to lack of drainage. The Manitoba Railway offers $25,000 if the State of Minnesota will appropriate $100,000 to be devoted for the benefit of settlers, a sum which experts say will go a long way towards draining the land in question.

AN OCEAN CABLE is to be laid by the cable steamer *Faraday* between Key West and Cuba.

THE THOMSON-HOUSTON ELECTRIC CO. is increasing its capital stock from $1,000,000 to $4,000,000. It proposes to give 1,000,000 of new stock to present holders, allow $1,000,000 to be subscribed for at par by stockholders, and leave the third million to be issued as the directors may see fit.

ORGANIC MATTER IN LONDON WATER.—In their report to the water companies on the water supplied to London during February, Mr. WILLIAM CROOKES, F. R. S., Dr. WILLIAM ODLING, and Dr. C. DEYMOTT TIDY say: It may be well to re-state that our estimate of the degree of freedom of the water from organic matter is based mainly on the concordance of two sets of determinations—namely, a daily determination, by means of permanganate of potash, of the weight of oxygen expended in the oxidation of organic matter present in a daily collected sample of each company's supply; and in a weekly determination, by the combustion process, of the weight of organic carbon present in a weekly sample of each company's supply, collected on some one day during the week. In this way, the mean weights of oxygen expended in the oxidation of the organic matter present, per gallon, in the Thames-derived water in the months of January and February, were found to be .062 and .056 grain respectively; while the mean amounts of organic carbon present in 100,000 parts of the water were found to be .170 and .161 part respectively. The maximum amount found in any of the samples examined in February, or .173 part in 100,000 parts of the water, corresponds, as nearly as may be, to about one-third of a grain of organic matter per gallon. In the case of the East London Company's water, the mean weight of oxygen absorbed from the permanganate was found to be .045 grain per gall.; and the mean amount of organic carbon was found to be .145 part in 100,000 parts. Or we may put it this way: Every ton of water supplied by the company contained 0.0032 lb. or 0.05 oz. of organic carbon; or in 308 tons of water there would be 1 lb. of organic carbon. Even this is practically all vegetable carbon, and a man would have to drink a gallon of water per day for 190 years before consuming 1 lb. of the organic carbon.

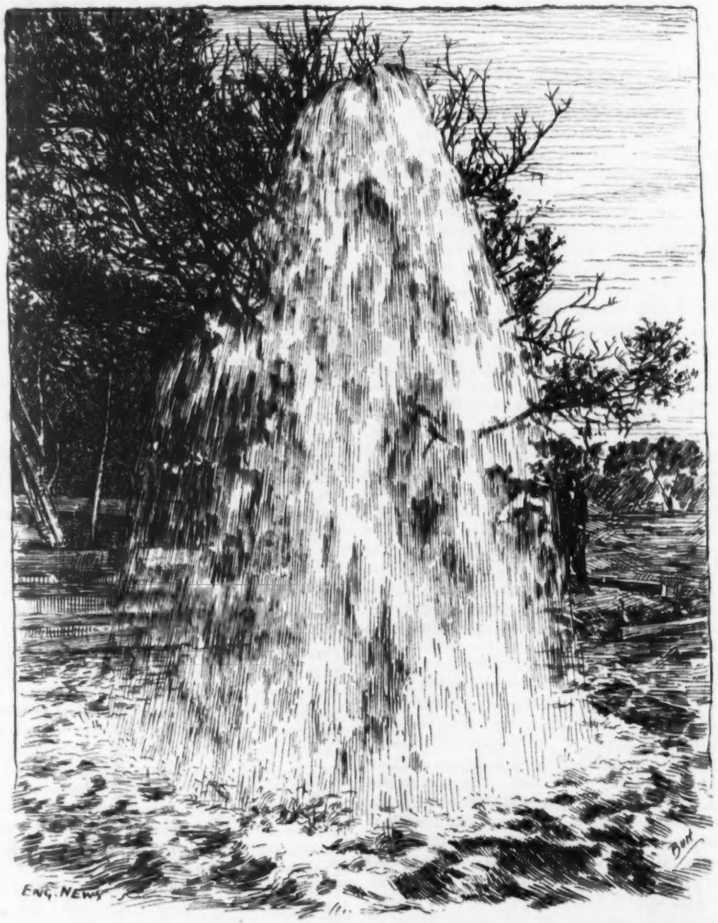
THE MANKATO CEMENT WORKS, belonging to the Standard Cement Co., of Hartford, Conn., are described in the *Pioneer Press* as including a plant valued at $125,000 and controlling several hundred acres of land underlaid with cement rock. These works, started in 1883, employ about 125 men, and have a daily capacity of 1,000 bls. of cement. The bulk of this product is sold in paper sacks instead of barrels. The same authority says that 125,000 bls. were used in concrete pavements in Omaha and Lincoln, and 40,000 bls. are to go into the new capitol at Denver.

The Great Artesian Well at St. Augustine, Florida.

Florida abounds in lakes, rivers, and springs of great volume of discharge, fed mainly by subterranean reservoirs of unknown extent in the rotten limestone formation which underlies a considerable part of the peninsula. Some of the springs in this State are of enormous discharge, and among the more important may be mentioned the following: The Silver Springs, which supplies a very considerable portion of the flow of the St. Johns river, and the Homosassa river on the west coast which flows from a rocky basin about 80 ft. in diameter, and forms a river over 15 miles long, flowing with a current of 5 miles per hour towards the Gulf. About 12 miles from Tallahassee is a great spring said to be 1,500 ft. deep with an outflow that forms a broad lake of ice-cold water. But perhaps the most interesting of these outbursts of subterranean waters are found along the coast-line, five or more miles from shore, like the one opposite St. Augustine, which perceptibly affects the surface of the ocean in a circle over half a mile in diameter, and forms a flat cone with an apex slightly elevated above the general surface. Another of these great ocean springs bursts out at Key West, and smaller ones show themselves at many points along the coast of Florida.

As underground-water is so abundant in this region, and is very generally under sufficient pressure to force it to and above the ground surface, it is little to be wondered at that artesian wells are there popular, and to a considerable extent relied upon for water-supply. But the most powerful well yet developed in that country is the one put down by Mr. H. M. FLAGLER for his great hotels at St. Augustine, and it is this one we illustrate and will now describe. The cut here given shows the outburst of water as it was first tapped, and before it was piped and controlled. We are indebted for the data used to Mr. WM. KENNISH, who had charge of the sinking of this well in connection with his other duties of construction described in a previous issue.

The artesian well at the Ponce de Leon was commenced in November, 1886, with a diameter of 12 ins., and by February, 1887, it had reached a depth of 1,390 ft. below the surface, with a yield of 10,000,000 galls. of water in 24 hours, and a pressure of discharge sufficient to force the jet 42 ft. above the mouth of the well. Though this great volume of water was struck at a point only 1,100 ft. below the surface, and the quantity was more than ample even to meet the demands of the mammoth hotels which it was proposed to supply, at the earnest request of his Superintendent Mr. FLAGLER had consented to sink the well still deeper in an attempt to pierce, if possible, the fossiliferous limestone formation, and practically test the question of increase in temperature in the water. But unfortunately, the boring-tools were lost just as the 1,400 ft. point was being reached, and the experiment was for the time at least abandoned. It may be proper to state here that the purpose of sinking deeper was to obtain water of a sufficiently high temperature to be utilized in supplying heat in the hotels, and possibly power. With the temperature of 82° Fahr. actually secured after the water had been piped, this hope has been realized to the extent of supplying a huge bathing pool in the Alcazar hotel with water at 82° Fahr. as before described, and in rendering all radiators and artificial heat in the hotels altogether unnecessary. This water, conveyed in a system of pipes, does all the heating the climate demands.



The Artesian Well at the Ponce de Leon Hotel, St. Augustine, Florida.
Showing Outburst of Water, when First Tapped.

While the volume of water discharged is greater than that of any artesian well in this country of which we have any knowledge, the pressure at the point of discharge is also over four times that of the artesian well at Charleston, S. C., which is the nearest boring on the level of the Atlantic coast. This pressure is utilized at St. Augustine by a turbine wheel, and the power obtained runs over 150 electric lights used about the hotels and grounds, and other machinery. Electricians note that this power is the most uniform of any yet employed by them for a similar purpose. While geologists ac-

count for this pressure purely upon the formation of the peninsula and the usual conditions controlling flow from artesian wells, there are others who disagree with them in this particular case. It has been suggested, with some reason, that the presence in great quantity of sulphuretted hydrogen gas in this water may have something to do with the ejecting power. The water of the Ponce de Leon well is charged with this gas to an unusual extent and it is simply white with the minute bubbles of this gas at the point of discharge. The water contains considerable mineral matter, but the gas escapes at once on exposure to the air, and the water is fit to be used for all purposes of domestic consumption.

Whatever may be the cause, the fact has been here demonstrated by the enterprise of Mr. FLAGLER that water in great quantity, under a very considerable pressure, and with a high temperature, can be obtained at comparatively little cost in this region; and as a source of cheap power for manufacturing or other useful purposes, it would seem to invite further investigation into its possibilities. The stratum of stiff, impervious blue clay overlying the water-bearing formation at this point is nearly 100 ft. thick, and the conditions appear peculiarly favorable for artesian borings, with a practically unlimited supply of water to draw from. And more powerful water-courses may yet be awaiting development in this remarkable portion of our country.

The actual well-sinking was performed by Mr. DANIEL DULL, of New York, a leading contractor in this line of business, and during the sinking operation a daily record was kept of progress and material penetrated. This record is here given in a condensed form, as follows:—

Date 1886.	*Temperature.*	*Thickness of stratum, feet.*	*Total depth, feet.*	*Materials penetrated.*
Nov. 27	62° F.	35	35	Sand.
" 30	....	15	50	Sand with shells.
Dec. 2	....	7	57	Blue clay.
" 4	....	8	65	Coquina.
" 6	....	11	76	Sand and indurated clay.
" 14	74° F.	94	170	Blue clay. Sulphur water.
" 20	....	7	177	Magnesian limestone.
" 24	76° F.	....	350	Fossiliferous limestone, with 1,800 galls. per minute.
" 27	....	....	410	Flow 3,000,000 galls. per day.
" 28	....	....	495	
" 29	79° F.	....	520	Dense light-brown limestone.
" 31	....	....	557	White chalk, green clay, and dark porous limestone.
Jan. 4	....	....	675	Fossiliferous limestone. Sand pumping resumed, showing that the limit of sulphur water was reached.
" 5	....	....	685	
" 6	....	....	770	Fossiliferous limestone.
" 22	....	....	960	Hard drilling.
Feb. 1	80° F.	....	1110	
" 2	....	....	1115	Hard drilling.
" 2	....	....	1120	Chalk indications.
" 3	....	....	1135	Hard drilling in sandstone, with flint.
" 4	....	....	1140	Same as above.
" 7	....	....	1170	Limestone again. Water 17 grs. hard.
" 9	....	....	1225	Ditto.
" 11	....	....	1278	Sandstone.
" 12	....	....	1295	Fossiliferous limestone again.
" 14	80° F.	....	1340	Ditto. Very soft drilling.
" 16	....	....	1390	Harder limestone. Microscopic fossils.

In this record it is shown that the surface water did not penetrate below a point about 50 ft. below the mouth of the well. At 170 ft. down, a flow of about 50 galls. per minute of sulphur water was struck; and on penetrating the next 7 ft. of magnesium limestone, this flow increased to 350 galls. At 410 ft. down, the volume of water was 3,000,000 galls. in 24 hours, with a temperature of 76° Fahr., and at 520 ft., this volume was suddenly increased to 7,000,000 galls. in the same period of time. At a depth of 1,100 ft. the outflow was 10,000,000 galls. daily discharging with a head of 42 ft. above the mouth of the well. This last amount was not materially increased when the drill had reached a point 1,390 ft. below the surface, but the temperature of the water was raised to 86° Fahr.

The average ratio of increase in temperature of the water in this well was about one degree for each 50 ft. of depth. This agrees very closely with that of the artesian well at Charleston, S. C., which in a well 1,106 ft. deep ranged from 68° Fahr. to 88° Fahr., or an average of one degree for every 52½ ft. in depth. The Paris well, of Grenelle, is 1,797 ft. deep, with a maximum temperature of 82°, and an average increase of one degree in every 58 ft.; while the St. Louis artesian well, 1,575 ft. deep, shows a gain of only one degree in each 83.3 ft. of descent. The water obtained from the Charleston well is saline and disagreeable to the taste, but very soft in quality; the drill passing through sand, marls, alternating strata of hard sandstone rock, and loose sands, and finally penetrating marls of cretaceous formation. The diameter of the pipe is 6 and 3 ins. and the yield of water is about 1,200 galls. per hour rising 10 ft. above the surface. The St. Louis well water is very unfit for domestic purposes; it has a strong odor of sulphuretted hydrogen and contains 8 per cent. of mineral matter, mainly salt. The pipe ranges in diameter from 9 to 3 ins. and the discharge is 4,500 galls. per hour. A 3 in. well at Louisville, Ky. is 2,086 ft. deep, and flows at the rate of 13,750 galls. per hour. The water of this well is very clear, but is highly charged with mineral substances similar in composition and medicinal properties to the celebrated Kissingen waters and the Blue Licks in the Kentucky. The famous well of Grenelle flows at the rate of about 20,000 galls. per hour from a bore decreasing from 12 to 6 ins. The water is limpid, but is practically only used for warming the hospitals at Grenelle. The Passey well, 2 miles from Grenelle, yielded at first, from a well 2.4 ft. in diameter, a flow of 5,500,000 galls. daily; but it very evidently draws its water from the same basin as its neighbor, and they are alike in quality and temperature of 82° Fahr. These are a few of the greater artesian wells, noted simply to compare some of their characteristics with the well at St. Augustine. Many others exist of considerable importance in the more elevated areas of the United States, and in a number of cases they furnish the smaller towns with their domestic supply of water. It is very possible that from a lack of detailed information, we have omitted mention of some that should properly have been included in our comparison; but those given are probably sufficient for the purpose intended—which is to call more particular attention to the possibilities of Florida for artesian well development and to invite further investigation into the controlling conditions of the outflow at St. Augustine.

The Memphis Sewerage.

The first official report upon the actual working of the much-talked-about Memphis system of sewerage has appeared within the last few weeks in the shape of a report to the City Engineer, Col. MERIWETHER, by Mr. R. F. HARTFORD, the Superintendent in charge of sewers. After giving statistics of work done during the past two years, and noting in this portion that he has had to remove obstructions 297 times from the 6-in. pipe, Mr. HARTFORD says:

Now that large extensions of the sewerage of the city are demanded, it is best to discuss the defects which 9 years of operation have developed in our system, that we may see what to avoid and what to adopt. It is from failures and not from success that the best experience is obtained; so we may find valuable lessons here.

The successful operation of the system depends more largely upon the certain action of its flushing apparatus than upon, perhaps, any other detail. It must be admitted that the FIELD automatic tank, as used here for the past 9 years, has proved quite uncertain in its action. This may be attributed partly, no doubt, to unskilful setting, partly to the use of a water heavily charged with sediment, but mainly to defective form and proportions. There are other tanks and other forms of this tank, greatly superior to that first introduced and which we are using. I would suggest that we procure the best for all future work.

The depths of the sewers in many places have proved wholly inadequate. Large business blocks and warehouses are erected, in which extensive appliances for heating and for handling goods and merchandise have been introduced. These are most conveniently placed in basements and cellars—in general, no other position is admissible—and their waste becomes a legitimate portion of the city sewerage. Our sewers are, as a rule, too shallow to receive it. It is now too late to remedy this to any great extent in the present work; but in all future extensions we may well consider this call upon the service, and meet it, and yet not depart from the original purpose of the system.

The sewers are also much too shallow even for the proper removal of household waste. House drains should have as great an inclination as practicable, and this should be uniform throughout. No gradient less than one in fifty in 4-in. drains should be used, excepting when special flushing apparatus is provided. This is very rarely obtainable, owing to the shallowness of the sewer with which the connection is made. The result is emphasized in the fact that quite two thousand obstructions have occurred in the house drains of this city within the past twelve months. Other causes may have aided in producing this result, but the principal cause is doubtless slight gradients.

The general omission of man-holes in the original system was a mistake which we are now correcting. Time has fully shown that direct means of access to the sewers, both main and lateral, are requisites; and such means are only supplied by man-holes. It is suggested that these be built at every intersection throughout the older system as rapidly as practicable, and be so formed that they shall offer no impediment to flow. In extension of the system, we shall fully rid ourselves of another defect, that lying in changes of gradient and alignment, by making all changes in direction at man-holes, connecting them only by lines that shall be straight and smooth.

The greatest defect is that our main and submain lines are much too small. This becomes very serious in view of the demand now made for the extension of the system southward; for we have already reached the limit of service for the territory south of Munroe St. and east of the bayou and are nearing the limit for the territory west.

The limit of both mains is reached and passed. Relief should at once be sought and secured. The only remedy looking to permanency lies in the construction of new and larger mains or in the building of auxiliary ones. A temporary relief might be found, for the west main, in remedying an error made in its construction. It is found that more than 500 ft. of this line was laid on a dead level, through mistake in the original survey, and this portion is just below where the surcharge is the greatest, indicating a very serious check in flow. It is practicable to relay this portion with a good and uniform gradient and remove the surcharge. I believe, however, that a permanent and satisfactory relief can only come with the construction of new main lines of a proper size.

If we have been taught anything by our experience, it is the fact that mere lines of piping do not make a system of sewerage. A system, to be of the highest efficiency, and of economical operation, must be carefully designed and detailed, and time is necessary to properly do this.

In conclusion, I earnestly recommend that a skilled inspector be employed to examine, test, and report upon the work done under the plumbing ordinances. Bad practice has now become the common practice, and it is clearly attributable to lack of intelligent supervision. Our force is too small to make this.

It is certain that poor and illegal work is costing this department a large sum each year for cleaning and repairing sewers, and it is not improbable that it has caused, prematurely, our overcharged mains.

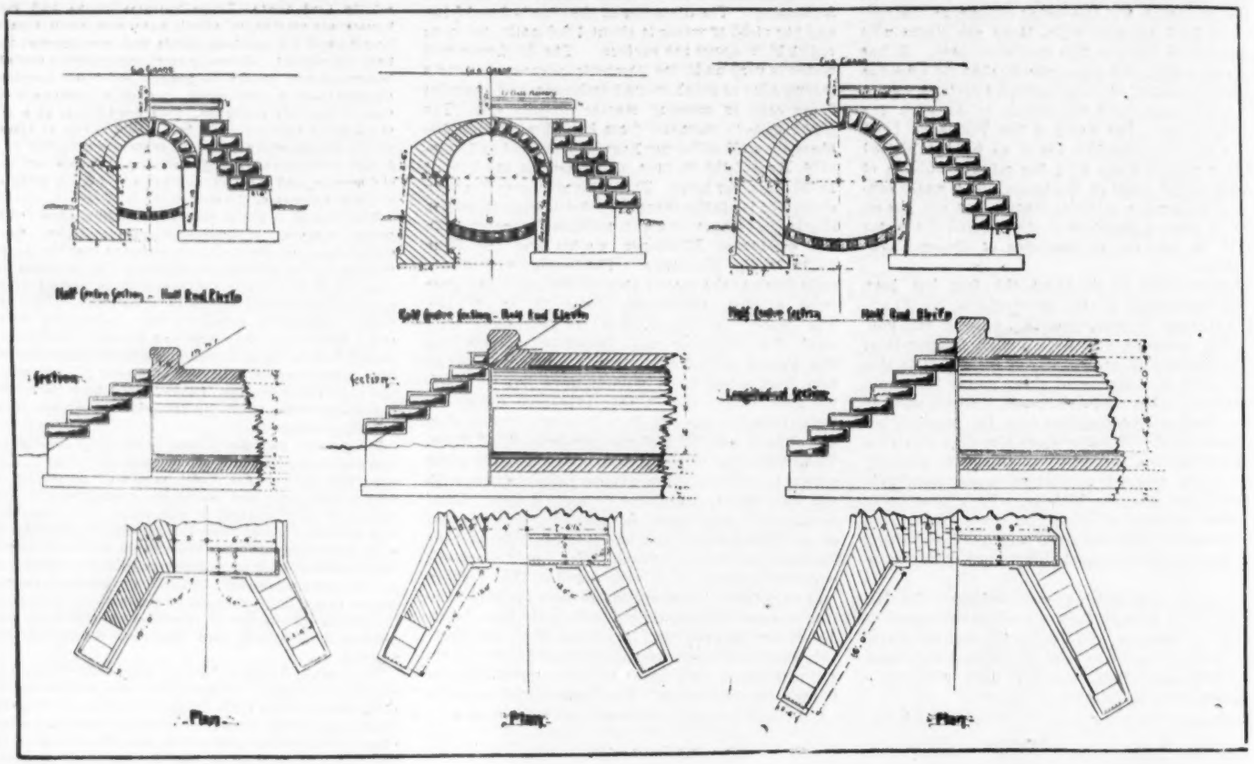
In designing an extension of the system for the new district of Chelsea, Mr. HARTFORD adopts the following general principles, based upon the experience of the last 9 years:

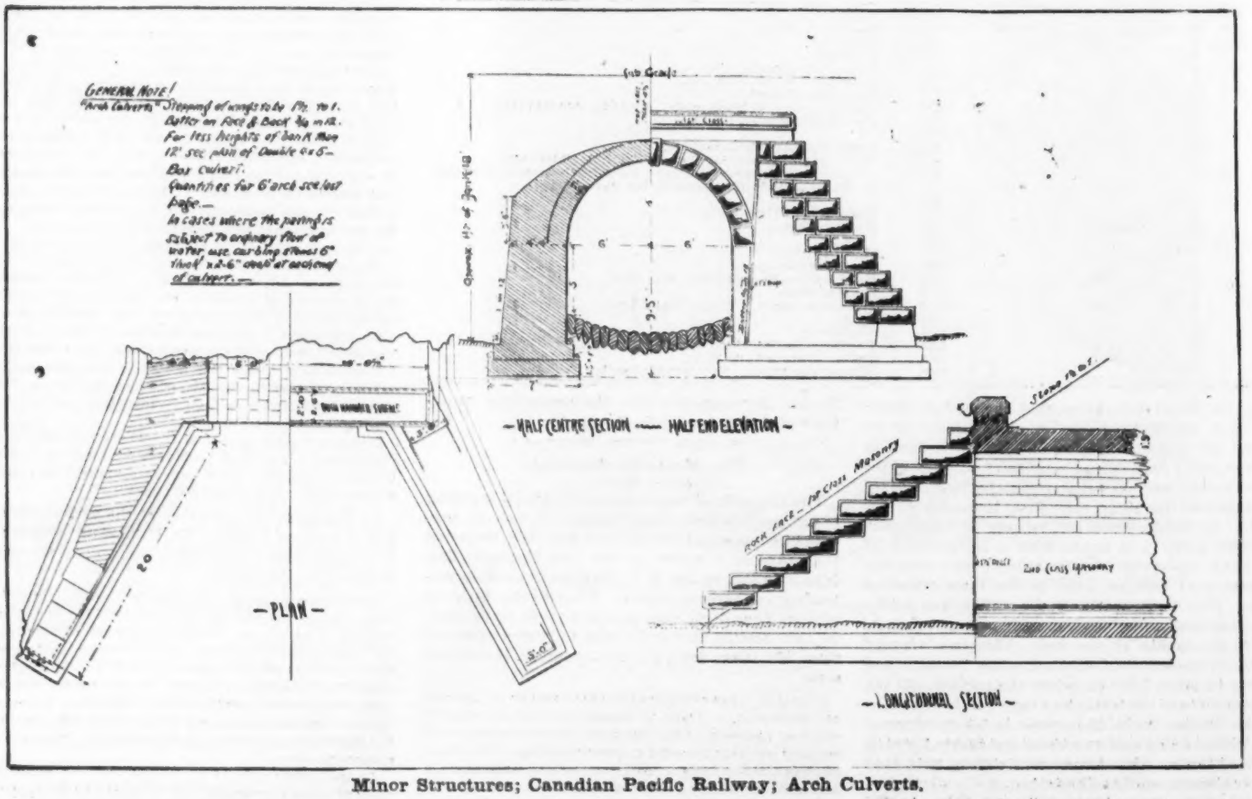
The minimum size of pipe used in lateral lines will be 8 ins. No curves will be admitted into the system excepting in man-holes, where all changes of alignment, both vertical and horizontal, will be made. A man-hole will be built at every intersection, which will place them about 380 ft. apart. Channels of the proper size and form, straight and curved, will be moulded in the cement floors of the man-holes, care being taken that sufficient fall is secured on curves to overcome all frictional resistance to flow.

At the upper ends of all lateral lines an automatic flush of suitable capacity will be placed to discharge directly into the sewers.

House-connection branches will be extended to the sides of the street or alley in which the sewer may lie. They will be of 6-in. clay pipe, cement jointed, and have at their upper ends an "increaser," from 4 to 6 ins., to receive the house drain, which will be 4 ins. in diameter. This feature will enable us to get a better fall to the house drain, and it is believed we will be relieved from the now common annoyance of opening pavements to remove obstructions in house-connection branches.

This district is very favorably located for the construc-





Minor Structures; Canadian Pacific Railway; Arch Culverts.

tion of a model system of sewerage, being so laid out that every portion may be served by sewers placed only in alleys, leaving the surfaces of all streets free from any future disturbance for connections, repairs, or the removal of obstructions. It is believed, however, that all danger from obstructions is removed by providing pipes of ample size and gradient, the introduction of manholes, placed within easy distance of each other, and the avoidance of all curves between.

The views expressed by American and English engineers seem therefore to have been fully confirmed by the experience gained since 1880 and from the conclusions drawn in this first official report. Had the Memphis sewerage been planned upon the principles contained in Rawlinson's "Suggestions," familiar to most of our engineers, instead of upon untried principles, the city would now not be obliged to face the ultimate necessity of reconstructing most of her present sewers.

Arch Culvert Plans, Canadian Pacific R'y.

In continuation of a series, commenced Dec. 29, of the minor structures on the Canadian Pacific Railway and the International Railway of Maine, its eastern extension, we present plans for arch culverts, from 6 to 12 ft. span. The drawings, which are intended as standard plans, are self-explanatory and require little remark, at this time at least.

Modern Explosives.

The chemistry, physics, and practical uses of gunpowder, dynamite, and other explosives formed the subject matter of an interesting lecture, delivered on March 5, before the Philosophical Society of Kilmarnock, by Mr. JOHN GUTHRIE KERR, M. A., lecturer on physical science in the E. C. Normal College, Glasgow, reported in the *Iron and Coal Trades Review*. After dealing with the knowledge possessed by the ancients of the properties of saltpetre in relation to bituminous bodies, and the experiments of ROGER BACON, the lecturer said that the action of gunpowder, so far as results went, was similar to that of all explosives—out of a small mass a large volume of gas was rapidly developed at a high temperature, and there followed a straining, displacement, or shattering of such obstacles as opposed the change. The theory also of its action was identical with that of the new allies, and belonged to the subject of thermo-chemistry. Here the lecturer referred to the work in this important department of science accomplished by the French chemist BERTHELOT.

The problem which had to be solved was—the obtaining an explosive more powerful in its effects, capable of being manufactured, transported, and handled with more safety, having greater resistance to the influence of water, and emitting, on explosion, less baneful gases than gunpowder. The solution of the problem commenced with SOBER'S discovery of nitro-glycerine in 1846. This explosive, which is an ether obtained from the alcohol glycerine by the action of nitric acid on glycerine in the presence of sulphuric acid, remained a laboratory curiosity for seventeen years. Then came ALFRED NOBEL, at once scientist, engineer, and enterprising man of business. He took the dangerous liquid, dissolved it in methylated spirit, and found transport safe. Adding water, the nitro-glycerine separates and may be used.

The next stage was also an adulteration. Near Hanover are large beds almost wholly composed of diatomaceous relics. This "kieselguhr" has great absorbing gifts, and NOBEL found it possible to completely conceal 75 parts of the liquid in 25 parts of this powder. This mixture, dynamite as now made, he found capable of standing the severest tests. In 1874, before a Commission of Inquiry, one 56 lb. box of dynamite was burned without explosion. Another was allowed to drop over a cliff 130 ft. high to rocks below, and while the box was smashed, the dynamite was not affected. Nitro-glycerine, however, exudes from dynamite immersed in water; and NOBEL'S next effort was so to fix the nitro-glycerine that the danger arising from this might be averted. Further, it seemed desirable that the fixing compound should not be inert like "kieselguhr." This was effected by utilizing PELOUZE'S discovery of gun-cotton (tri-nitro-cellulose) in 1838. This substance, itself an explosive, but with slight defect of oxygen, was found to dissolve in nitro-glycerine, which contains for explosion a slight excess of oxygen, and with these two was formed the theoretically perfect explosive—blasting gelatine. The parts are 3 per cent. of gun-cotton to 97 per cent of nitro-glycerine.

In explosive effect, blasting gelatine is 50 per cent. better than dynamite, and is described by Sir FREDERICK ABEL, our greatest authority on explosives, as the cheapest, the safest, and most perfect. It is entirely unaffected by water, and cartridges which have been immersed for seven years in water have at the end of that time developed their full power when detonated. Gelatine-dynamite is a modification of blasting gelatine, somewhat cheaper in manufacture, and having in use more of a heaving action. It is made of 80 per cent. of blasting gelatine, not quite gelatinous, wood, meal and saltpetre forming the other 20 per cent., and is largely used in the fiery mines in England as the cartridge in SETTLE'S patent. This invention consists of a water-tight bag, in which the cartridge is kept in position in the middle of the water in the bag by tin supports. The charge is exploded by a detonator set off by a current of electricity. No flame follows the explosion, and accordingly the risk from fire-damp is minimized. Within the last two years attempts have been made to meet the disadvantages of forming such large bore-holes as this invention requires, and to diminish the trouble which the miner has in manipulating the apparatus.

The explosives for which is claimed at least equal power, but entire absence of flame, are known as roburite, carbonite, and bellite. These compounds are nitro-substitution derivatives of benzol associated with nitrate of ammonia. In bellite, the discovery of CARL LAMM in 1887, the proportions are five parts of the ammonia salt to one part of di-nitro-benzol. This explosive is said to be 30 per cent. stronger than dynamite, absolutely safe for transport, and flameless. Regarding entire absence of flame in the explosion of those nitro-benzol compounds, there seemed to be want of evidence as to the effects of other than comparatively small charges under favorable conditions. In the meantime, the claim could not be considered as made good, whatever the promise might be. Compared with blasting gelatine, bellite is inferior so far as concerns power of withstanding water, as might be inferred from the presence of such a large proportion of nitrate of ammonia; if, as a protection against water, it be covered with a water-proof mixture, it becomes less adaptable for the complete filling-up of bore-holes in blasting operations.

Elevated Railways in Boston.

Of the list of annual petitioners for charters from the Massachusetts Legislature for various forms of elevated roads for Boston, those representing the Riley system this year take the lead. Capt. MEIGS has not appeared, but his incorporators have recently qualified by paying in a sufficient amount to take their charter, granted last year, and it is presumed work will be begun on the line from Bowdoin Square to Harvard Square, Cambridge, as soon as the money questions and necessary preliminaries as to provisions for damages, etc., can be arranged.

The Ames, Mack and Mayal systems were represented by other petitioners, and were opposed by the lawyers of certain real estate interests and of the West End Street Railway, as usual. The hearings of the Riley system petitioners, F. A. BARTHOLOMEW, President, were closed March 25. The incorporators are, all but one of them, capitalists of some prominence residing in Boston or vicinity. The proposed line is to begin at the Boston & Lowell R. R. station, pass the Eastern, Fitchburg, and Boston & Maine R. R. stations, thence along Atlantic Ave., passing the Boston, Revere Beach & Lynn ferry terminus, and with a short spur extending on Federal St., to the Post Office, pass the Old Colony and Boston & Albany stations to Dover St. Here the line divides into three branches, one on the right extending to the Boston & Providence station at Park Square, thus connecting all the railroad stations in the city, another branch to the left, running through South Boston to City Point, while the main line continues to Roxbury, terminating at Mattapan. An extension on the North to Charlestown and Chelsea is also contemplated.

The provisions of the bill presented are briefly:—capital stock of $250,000 per mile of single track and $500,000 per mile of double track is to be paid in cash before any construction is to be entered upon. Bonds may be issued to an extent equal to the cash capital paid in, and for money borrowed, etc. The city government is to prescribe the height of girder above the street, and fix the location in the street. The gauge and grades are to be approved by the Railroad Commission, also the strength of the constructions and strength and safety of the rolling stock and motor power, before the road can be put in operation. The company is to use an approved form of electric motor, and to light the streets through which the road runs, by electricity, in a manner to be approved by the Board of Aldermen.

The rates of fare are not to be increased on those now in use upon the street railways. The stations, so far as practicable, are to be on the second floors of the buildings on the line of the road, and connected by platforms only with the tracks. The charter is to become void in three years unless the road is previously built. Provisions for damages are made as usual, and they become a first lien on the whole property of the company. The company also is held liable to all the provisions of the law relating both to steam and street railways, so far as applicable.

It would seem as though so apparently fair a bill ought to pass; for the need of some new method of obtaining more rapid transit is pressing, owing to the entire inadequacy of the street railways to sufficiently accommodate the public travel, and the impossibility of providing by the present means of conveyance for the growth of travel in the future.

The Water-Works of the Hague, Holland.

The water-supply of the Hague is collected from a piece of sandy foreshore covering about 1,600 acres. This is rain-water, falling on this area, percolating through the sand, collected, filtered and distributed. The original collecting canal, started in 1872, was nearly 3¼ miles long, with numerous small branches, the width of the canals varying from 10 ft. to 20 ft. The ground-water level varies on this line from 3¼ ft. to 26 ft. above datum level.

In 1874 the works were completed with a capacity of 900,000 galls. daily, but in 1880 the consumption had so increased that a larger supply had to be considered. Owing to local conditions it was determined to deepen the existing canals instead of extending them, so as to gain a larger percentage of the surface water from the same area. As much of the water collected was lost by evaporation, Mr. WALDORP, the engineer, substituted pipes for the open canals. The system adopted was to lay partly open joints earthenware pipes of 21 ins. diameter for the main and smaller pipes for the branches.

These pipes were laid in trenches kept dry by a centrifugal pump. The trenches were supported by planking placed in the sand by attaching a small pipe to a plank (2 × 7 in. × 8 to 20 ft. long) and connecting the pipe by a flexible hose to a hand pump. With this water jet, two men could place 12 to 15 planks 8 ft. long in one hour. As much time was lost in hauling up the pipe and reattaching it, the engineer devised an improved plan, as follows:—An iron pipe was used as before, but instead of a bottom opening only, it had two rows of holes bored in the length of the pipe and opposite to each other. This pipe was connected to a more powerful force-pump, and after it was once forced vertically into the sand it was dragged along, and cut a continuous trench, into which the planks were set. By this arrangement four men could place 80 to 100 planks per hour, while as many as 500 could be lifted in the same time.

With the trench cleaned out to within 18 ins. of the bottom of the planks, a 4-in. layer of shell-sand was spread on the bottom and the pipes laid on this. About 8 ins. from either side of the pipe planks were placed, and the interval was filled also with shell-sand covering the pipe to a depth of 4 ins.; over this was placed a layer of coarse river sand, and the trench was then filled up with the ordinary sand and the planks withdrawn. The object in the bedding method was to keep the fine drift sand out of the joints.

At the intersection of main laterals with the main collecting conduit a circular well is sunk by digging down and pumping out, and then curbing the well with concrete rings. More complete data on this subject will be found in a paper read before the Dutch Royal Institution of Civil Engineers by Mr. TH. STANG.

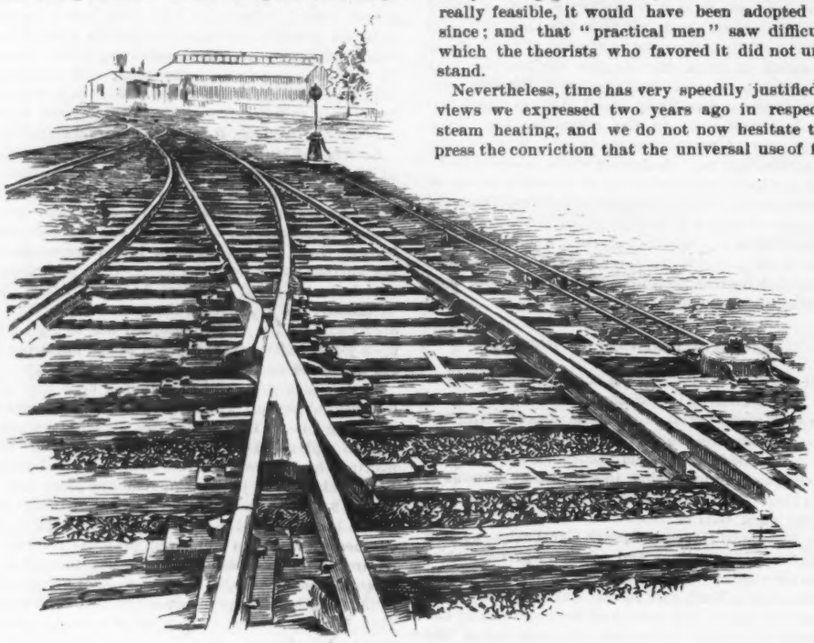
CANADIAN RAILWAY COMPETITION.—The Interstate Commerce Commission began Apr. 4 a hearing of the case against the Grand Trunk Railway company, in which it is charged that the company has violated the Interstate Commerce law by granting rebates on traffic from points in the United States to points in Canada, and by charging on such traffic less than its published rates.

Mr. OTTO KERCHNER, counsel for the Grand Trunk company, denied that the company had granted rebates to American shippers; but he acknowledged that special rates had been made to Canadian receivers on shipments of coal from Buffalo and Black Rock, and also that rates charged to shippers from these points had been considerably less than the published rate.

He contended that this traffic, from a point in the United States to a point in Canada, was not controlled by the provisions of the Interstate Commerce law; and claimed that the proper interpretation of the clause limiting the jurisdiction of the act to "any common carrier engaged in the transportion of passengers or property . . . . from any place in the United States to an adjacent foreign country," would be "to the border of an adjacent foreign country," and not "into that country."

The Price Frogless Switch.

The necessity of providing, if possible, for necessary turnouts, without cutting the main rails, is becoming increasingly evident from the simultaneous multiplication of trains on main track and of turnouts and sidings from it, made necessary because of increasing traffic. As a consequence, the disproportion between the number of trains which pass a siding on the main track and the number which actually takes any one given siding is steadily increasing. Moreover, speeds are increasing and are likely to continue to increase, especially after the use of freight train brakes and automatic couplers has become general.



The Price Frogless Switch.
Fig. 2. Switch Right for Side Track.

It is therefore greatly to be desired that some form of turnout switch should be devised which, when the switch is not in use, shall leave the main track absolutely unbroken, not only as respects the switch but as respects the frog. A number of accredited devices, most of them offsprings of the original Wharton, leave the main track unbroken at the points, and, when a double-track road has only trailing points, the objection to the ordinary split switch points becomes small, although it does not leave the main track absolutely unbroken. But the frog is always noisy, rough to ride over, expensive to maintain, and extremely liable to cause accidents by its own breakage or obstruction, or by causing breakage of a wheel or flange; and when a frog is passed over by a hundred or two main track trains for one which requires to use it, it becomes an obvious nuisance, aggravated by the inevitable tendency to multiply the number of such breaks in the track.

It is therefore, in our judgment, inevitable that ere long frogs in main track will begin to be comparatively rare, and used only when the travel on the two tracks joined is approximately equal; and that some substitute for a frog, embodying more or less exactly the general idea of the PRICE frogless switch which we illustrate herewith, will gradually come into general and standard use.

It must be admitted that the railway practice of the past half century has not even tended to break away from the use of frogs, any more than from the use of ties, apart from a few such experiments as that we illustrate, and all of these are quite recent; so that it requires some courage to predict that it must ere long come about; but then it required some courage to make a similar prediction in regard to the probable use of steam heating of trains from the locomotive only two or three years ago; for up to that time no progress whatever worth speaking of had been made, not (as is now apparent) because the problem really had any serious difficulties if properly studied and experimented on, but because it involved a departure which every one hesitated to enter on first, until its need had been enforced by a series of terrible disasters. Until this had come about, there was a general and natural tendency to ridicule the whole project as a visionary and impracticable notion, on the apparently strong ground that, if such a method were really feasible, it would have been adopted long since; and that "practical men" saw difficulties which the theorists who favored it did not understand.

Nevertheless, time has very speedily justified the views we expressed two years ago in respect to steam heating, and we do not now hesitate to express the conviction that the universal use of frogs for turnout curves is destined soon to stop; that a large majority of the main line frogs can just as well be dispensed with; and that the problem of devising an effective substitute is really not a difficult one mechanically, if it be once seriously undertaken, although precisely the best form is never likely to be determined until after considerable experience and experiment.

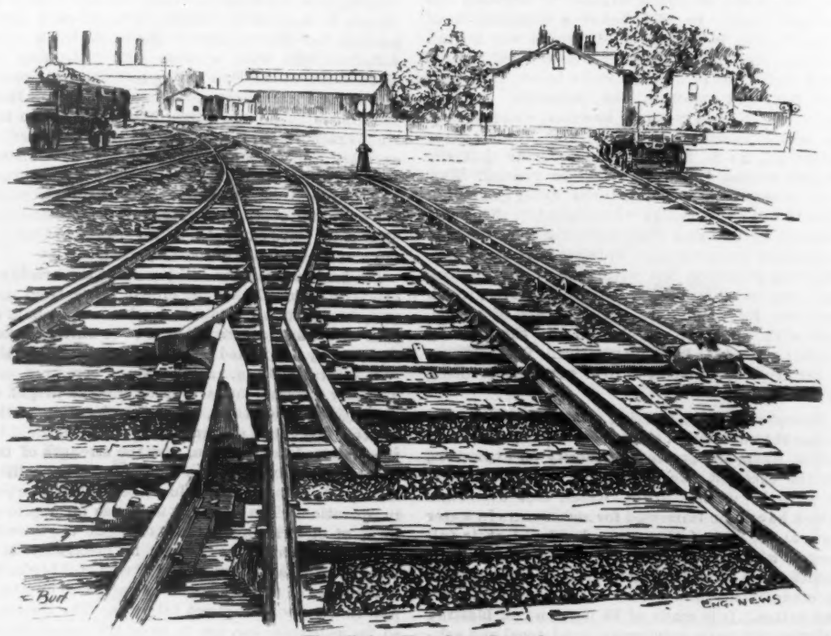
One of the most promising efforts in this direction that we know of is that herewith illustrated, the invention of Mr. CHAS. B. PRICE, Superintendent of the River Division of the Allegheny Valley Railroad. Three of these switches are now in use. The first two were put in early in 1885, and have been in use ever since, with some minor modifications. While the general idea of these switches was the same in all essential respects as that illustrated, the actuating mechanism was quite different, and there was no interior guard-rail. The device was illustrated at the time, but as the form we now show is regarded as an improvement it is needless to describe the earlier form in detail.

The switch which we illustrate was put in in May, 1888, and has been rendering good service ever since. Mr. PRICE writes us in regard to it:

> It is of considerably improved design as compared with its predecessors, being lighter and yet stronger, easier to throw and considerably cheaper. The photographs may give you a fair idea of its appearance when thrown for use to enter siding, and also when set for main track, giving an unbroken main rail in lieu of the ordinary fixed frog. I think the increasing speed of trains and weight of rolling stock are making it more desirable than ever that there should be a continuous main rail. It sometimes gives me quite a degree of pleasure to think that I am pioneering in this useful direction; but the engrossing nature of my everyday business gives me but little chance to push the matter as it ought to be pushed.

It will be seen that the frog substitute consists simply of three moving parts, all of which are actuated from the switch-stand at the same time that the points are thrown, and by the same movement. Of these, one is merely an inside guard rail, the further end of which (Fig. 2) constitutes part of the lead, and the near end of which serves as a wing rail to enable a main track train to run safely through the frog (it being held in place only by a spring, like a spring rail frog or spring point) if by accident a train should approach it on the main line when the switch was set for side-track. The two outside parts are special steel castings or forgings, hinged together (Fig. 1) so as to act simultaneously and effectively.

The result is, when the switch is thrown for side-track (Fig. 2), to form a platform on top of the main rail just high enough to give necessary solidity and to enable the flange to clear the rail. This super-elevation, being on the outside rail of the curve is a positive advantage, and the lack of it (for it is impossible to have it with an ordinary frog) perhaps explains many occasional derailments.



The Price Frogless Switch.
Fig. 1. Switch Right for Main Track.

A main line train (or still more a switching engine) can run through the frog perfectly well when set for side track in the position shown in Fig. 2. The inner guard rail is pushed away by the flange, being held up to position only by the spring of the usual form and strength for such springs about switches. There is an inclined plane on each side of the frog which rests on the main rail, and there is no more jolt in passing the opening for side-track flanges than in passing any other frog. Thus the

operation of "roping" can be carried on as well over this frog as over any other, while the main track, when the siding is not in use, is left absolutely unbroken, and all the jolting and wear and tear is saved. The design seems to us one of much merit.

Country Road Legislation in Pennsylvania.

In our issue of March 30 we made some remarks upon the bill presented to the Pennsylvania Legislature by the Engineers' Society of Western Pennsylvania, having for its purpose improvement in "the location, opening, vacation, construction and maintenance of highways, roads and bridges in the several counties of the Commonwealth." We are now indebted to Mr. S. M. WICKERSHAM, Secretary of the Society, for a copy of the proposed act, which we give in full as follows:

Sec. 1.—Be it enacted by the Senate and House of Representatives of the Commonwealth of Pennsylvania in General Assembly met, and it is hereby enacted by the authority of the same, that it shall be the duty of the Court of Common Pleas of the respective counties within this Commonwealth to appoint a Board of four persons, who, with the County Engineer or Surveyor, shall be constituted a Commission to classify all the thoroughfares in the county, not included within corporate boundary lines, and divide the same into three classes to be styled, respectively, Highways, Roads, and Lanes. "*Highways*" shall include all those radiating from the county seat to other populous points in the county, or to the boundary lines of the county, and those connecting such other populous points; or those which, by reason of their connection and extension in the same general direction, afford a continuous line of travel between such centers or to such boundary lines. "*Roads*" shall include all thoroughfares now designated as Township Roads, and which may not be classed as Highways, under this act. "*Lanes*" shall include what are now styled "Private Roads" and which are used only for ingress and egress from roads or highways to individual property.

Sec. 2. Said Court shall make such appointment within thirty (30) days after the passage of this Act, and it shall be the duty of said persons so appointed to meet at the county seats of their respective counties and organize by electing from their own number a President and Secretary, and shall then proceed without delay to make such classification, designating the several roads belonging to each class, and report their findings to said Court. The classification thus made by said Commission, or a majority thereof, shall be taken as final and conclusive in the matter, and the highways, roads and lanes thus designated shall be taken as such by all parties affected thereby. The compensation to be paid to said Commissioners shall be fixed by said Court, and paid by the County Treasurer as other salaries are paid.

Sec. 3. In every township of this Commonwealth, the qualified voters thereof shall, on the third Tuesday of February, 1890, elect one person to serve for one year; one person to serve for two years; and one person to serve three years, who shall be styled as "Road Directors"; and at each annual Township election thereafter, they shall elect one person to serve for three years, Provided, that in any township which has now three Road Commissioners, no new election shall be required, except at the times of expiration of the terms of such incumbents; and provided further, that the persons so elected as Road Directors shall have been citizens of the township in which they are elected during the three years immediately preceding the date of such election, and shall be freeholders in such township at said date.

Sec. 4. In case of any vacancy occurring from any cause, it shall be filled by appointment by the Court of Common Pleas of the proper county, until the next succeeding election, when the vacancy shall be filled by the electors of the township for the unexpired term.

Sec. 5. It shall be the duty of the said Road Directors to meet on the second Tuesday of March, 1890, and annually thereafter, at the place where the Auditors of the respective townships meet, and after being duly sworn by a Justice of the Peace to perform the duties devolving upon them by virtue of the provisions of this Act, they shall organize by electing one of their number as President, and one as Secretary, and shall proceed to levy a tax of not more than seven and one-half (7½) mills on each dollar of the valuation made by the township assessors for county purposes, and shall certify to the County Commissioners and County Treasurer the amount of such levy; the same to be collected by said Treasurer as other taxes are collected and to be set apart and kept as a Road Fund, which shall be paid out by him on requisition of the County Engineer, duly approved by the President and Secretary of the Road Directors.

Sec. 6. The Road Directors, in conjunction with the County Engineer, appointed as hereinafter provided, or his deputy or assistant, shall divide the township into Road Districts; and determine the prices to be paid per day for labor, the amounts to be expended in repairs, and in permanent improvements during the year, and the amount to be expended in procuring materials, tools, or machinery, deemed necessary to macadamize or otherwise to improve the roads; provided, however, that not less than thirty (30) per cent. of the road tax collected in each year, shall be expended for materials to macadamize or otherwise improve in a permanent manner.

Sec. 7. The Road Directors, in conjunction with the County Engineer, his deputy or assistant, shall have power to locate and open new roads, vacate existing roads, or change the location of the same, upon the petition of not less than six (6) taxpayers of the township in which the road is located, whenever they, or a majority of them, shall deem it necessary for the convenience or safety of public travel so to do.

Sec. 8. Upon receipt of said petition, the said Road Directors shall notify the County Engineer of such fact, whose duty it shall thereupon be to cause a survey to be made of the same, and make the necessary plans and profiles to show alignment, gradients, and lines of property affected thereby. In locating or changing such road, he shall be governed—1st, by ease of gradient; 2d, by directness of alignment; and 3d, by least amount of damage consistent with public utility.

Sec. 9. The Road Directors and the Engineer shall then be constituted a Board of Viewers, in the case, and shall proceed at once to give notice in writing, delivered by messenger, to the property owners interested, where that can reasonably be done, and by hand-bills posted along the line of the road so proposed to be opened, vacated, or changed; said notices to designate a time not less than ten (10) days from the date thereof, and a place on the line of said road, when and where they will meet to perform the requirements of said view. They shall then and there, after hearing all parties interested therein, decide as to whether or not the prayer of said petition shall be granted. In case of a tie vote, the decision shall be left to the Court of Common Pleas of the proper county, whose decision, after hearing the statements of the said Board, shall be final and conclusive in the matter.

Sec. 10.—In all cases wherein an affirmative decision shall be reached, the said Board shall proceed to estimate the damages and benefits to each party in interest, and shall cause a schedule of the same to be made, showing the names of all persons assessed, and the amounts of damages or benefits, and shall notify each of said persons of the amount with which he or she is charged or credited as the case may be. They shall file said schedule in the office of the County Engineer for ten (10) days from the date of such notice, during which time any person who may be dissatisfied with the amount of damages awarded or benefits assessed may appeal to the Court of the Common Pleas, of the proper county relative thereto; and the finding of the Board shall be final and conclusive as to the necessity for and location of any new road; as to the propriety of vacating either in whole or in part any existing road; as to changing the location of any existing road; and as to all matters relating thereto, except only the amounts of damages awarded or benefits assessed. The Court of Common Pleas, upon appeal as aforesaid, shall have jurisdiction in the case, with power to approve, amend, or to set aside the findings of said Board as set forth in the schedule aforesaid, and to order a review by a special Board composed of the Road Directors of another township with the County Engineer, and the findings of said special Board shall be final and conclusive upon all parties interested. The cost of such views shall be considered and taken as damages, and assessed as such, and where the damages exceed the benefits, the excess shall be paid out of the Road Fund of the township.

Sec. 11. After the final decision of the case, or after ten days if there be no appeal, the County Engineer shall file the schedule in the office of the County Treasurer for collection, the same to be collected as other taxes or debts due to the county are collectable.

Sec. 12. It shall be the duty of the Supervisor of the district in which any new road is located, or existing road changed, as herein provided, to proceed to open the same within ten (10) days after the decision of the Board relative thereto, and to place the same in safe condition for public travel, under the direction of the engineer, as soon as practicable.

Sec. 13. The width of all highways shall not be less than fifty feet; and of roads, not less than forty feet; provided, however, that all existing roads and highways, which have been established of greater widths than herein provided, under the provisions of previous statutes, or which have been constructed by incorporated companies, and have passed to public control by lapse or surrender of charter, shall be maintained at the widths so first established.

Sec. 14. The said Road Directors shall each receive as full compensation for their services, the sum of two dollars and fifty cents ($2.50) for every day employed in the performance of the duties perscribed by this Act, which sum shall be paid out of the Road Tax Fund by the County Treasurer on the warrant of the President of the Board, fully attested by the Secretary, by affidavit that such time has been actually employed in such duties.

Sec. 15. It shall be the duty of the County Commissioners to take cognizance of the classification so made, and to levy an annual highway tax on all property in the county, not exceeding seven and one-half (7½) mills on each dollar of valuation made for county purposes. Said tax shall be collectable by the County Treasurer as other county taxes are collected, and be paid out as herein after provided.

Sec. 16. The County Treasurer shall set aside seven and one-half (7½) per centum of all taxes collected in the county for State purposes, which, together with the highway tax levied and collected as aforesaid, shall constitute a highway fund, to be applied to the permanent improvement and repair of the highways so designated, and of all bridges constituting parts of such highways. Said fund is to be paid out on requisition of the County Engineer as hereinafter provided.

Sec. 17. The County Commissioners and the County Engineer shall constitute a Board for the improvement and repair of all highways and the bridges thereon. It shall be the duty of said Board to determine the amount and character of work to be done on each of said highways in each year; provided, however, that not less than forty (40) per cent. of the highway fund shall be expended in macadamizing or otherwise permanently improving the same. They shall, by advertisements in papers doing the county printing, solicit proposals for the furnishing of all materials needed, and shall let all contracts to the lowest responsible bidder.

Sec. 18. It shall be the duty of the Court of Common Pleas of each county of the Commonwealth, to appoint on or before the first day of January, 1890, and triennially thereafter, a competent Civil Engineer, of at least ten years' experience as such, to be styled "the County Engineer," and to serve for a term of three years. He shall give a bond in the amount required, and shall receive the same salary paid to a County Commissioner in the county for which said appointment is made; provided, however, that in every county in which there may now be a County Engineer of said qualifications, no appointment shall be made until the expiration of this term of service.

Sec. 19. It shall be the duty of the Engineer to make a map showing the location of all the highways, roads, lanes, and bridges in the county, together with their gradients; make all surveys for new roads and highways, and for changing location of existing ones; prepare plans and specifications for all work on highways, roads, and bridges; make and execute all contracts relative thereto which may have been authorized by the Board of Highways or by the Road Directors; have supervision, direction, and control of all work in connection therewith; arrange with the Road Directors for the execution of all work decided upon by them; and appoint such supervisors as he may deem necessary to oversee the work and have it properly executed according to his direction, said supervisors to be citizens of the township for which they are appointed, and to have practical knowledge of road making. He shall make such rules and regulations for the guidance of the supervisors as he may deem necessary, and have the same printed and distributed to the Road Directors and supervisors.

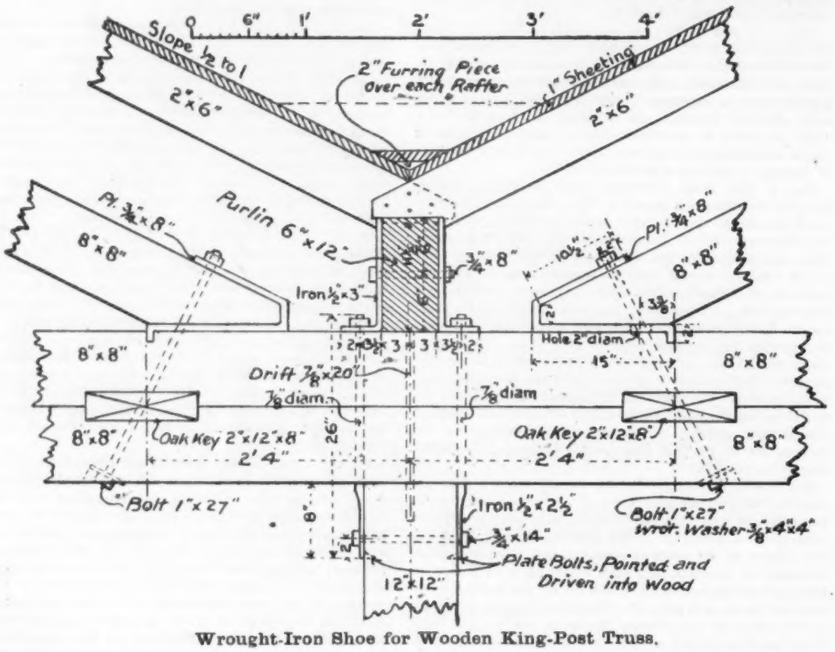
Sec. 20.—The County Engineer shall certify to the County Commissioners, monthly, sworn and detailed statements of the amounts severally due for labor and materials expended upon the highways of the county, under contracts then in force, and the names of persons to whom the same may be payable, which statements, when approved by said Commissioners, shall be sent to the County Comptroller, who shall issue his warrants to the County Treasurer, payable to bearer. The County Treasurer, on presentation of such warrants, shall pay the same to the bearer thereof, and charge the sum so paid to the Highway Fund or to the Road Fund as the case may be.

Sec. 21.—The County Engineer shall, at the close of each fiscal year, make a detailed report to the County Comptroller of all work done on highways, roads and bridges throughout the county, setting forth the number of miles of highways and of roads improved during the year and the cost thereof; the number of miles of highways and of roads previously improved and the cost of repairs thereon during the year; the number, location and lengths of bridges built during the year, and the cost thereof; the number and aggregate length of all bridges previously existing and the cost of repairs made during the year; the number and length of roads or highways opened, vacated, or changed during the year, and the cost thereof; together with a full report in detail of the condition of the roads and highways at the time of the report. And shall send a copy of the same, together with a copy of the road-map of the county, to the Surveyor General, whose duty it shall be to make a connected plan of the highways of the several counties of the Commonwealth, and shall make a summary report of the whole annually.

GRANITE FOR PAVING AND BUILDING PURPOSES is being sought for along the line of the Louisville & Nashville R. R. by a party of gentlemen chaperoned by officials of that road. The Atlanta *Constitution* suggests that this party visit Stone Mountain, near Atlanta, where they will find paving granite in inexhaustible quantity, that has been adjudged the best that Cincinnati could obtain, and cheaper than the Eastern article.

Wrought-Iron Shoe for King-Post Truss.

We are indebted to Mr. Ward Baldwin, Assistant Engineer of the Cincinnati, New Orleans & Texas Pacific Ry., for the detail illustrated herewith of a wrought-iron shoe for the lower end of the principal rafter of a wooden "king post" truss of moderate span. The advantages which the detail is claimed to possess are:



Wrought-Iron Shoe for Wooden King-Post Truss.

1. The lip projecting into the tie beam at the front end of the shoe is made strong enough to hold the principal rafters from spreading without any help from the bolt. This secures a greater area to resist shearing for a given length of the tie beam than when the entire shoe is let into the tie beam.

2. The shoe embraces the end of the principal rafter and thus secures it from splitting.

3. Being of wrought-iron, and of a shape easily forged, it is nearly as cheap as cast-iron, and will not break.

So far as we know, this design is new as well as original, and it certainly seems to possess merit.

Multipliers and Curves for Ascertaining the Discharge, etc., at Various Depths in the Same Sewer.*

The design and construction of sewers, and rules for calculating their velocities and discharges, have been repeatedly and exhaustively dealt with; but the author has, time after time, felt the want of some simple method of finding these quantities in the same sewer at different depths, without having to make repeated and vexatious use of the same formulas. Anything tending to simplify such calculations, which are hourly coming before the civil engineer, will be of interest, and, it is hoped, of practical value.

It occurred to the author, in the course of making numerous and hurried calculations of this nature, that there must be some ratio between the discharge, velocity, hydraulic mean depth, area, and wetted perimeter at different depths in the same sewer; that is to say, taking the discharge for instance, this must, at any depth, bear a certain fixed proportion to that at any other depth. The idea was examined, sifted, and investigated in a practical manner, the result being the present paper and accompanying tables.

The calculation for the five factors being easy when the sewers are running full, and this depth being the most convenient, it was taken as the standard, and the value of each factor, at the different depths, has been expressed in decimal parts of that standard.

In the case of circular sewers, a section of a culvert 10 ft. in diameter was divided throughout into depths of 6 ins. and each of the five factors was calculated at every segment of the circle, the fall of course being constant. In the case of egg-shaped sewers, a section of a culvert 10 ft. high by 6 ft. 8 ins. wide was dealt with in precisely the same manner.

The results, in each case, were noted down, and, by dividing the value of each factor at the different depths by that of the same factor due to the full depth, a set of figures was obtained which, when plotted on ordinates representing the different depths, produced a curve for each factor.

It will be noticed that the section of the egg-shaped sewer corresponds to the "old form," the transverse diameter being equal to two-thirds the depth, the radius of the invert equalling one-fourth of the transverse diameter, and the radius of the sides being equal to the full depth.

The figures have been deduced from calculations obtained by using the formulas generally accepted in dealing with sewers, namely.

$$V = 55\sqrt{2f \times r},$$

and

$$D = V \times A,$$

in which V = the velocity in feet per minute; f = the fall in feet per mile; r = the hydraulic mean depth, or area divided by wetted perimeter; D = the discharge in cubic feet per minute; and A = the area of the flow. The vertical figures at the tops of the tables, numbers 1 to 5 and 7 to 11 inclusive, represent the values at the different depths of each factor, expressed in decimals of its value calculated for the full depth, this being also taken as unity.

The tables are a condensed statement of the figures referred to for their respective form of sewer, from which the value of either factor at any depth can be easily and readily ascertained.

In examining the curves, it will be noticed that those for area and wetted perimeter increase continually to the full depth in both forms of sewer; that those for hydraulic mean depth and velocity attain their greatest value in the circular sewer at 0.80 of the full depth, and in the egg-shaped sewer at 0.85 of the full depth, in both cases being considerably greater than at the full depth; and that those for discharge in both cases reach the highest point immediately before they end. This shows that a circular or egg-shaped sewer running full is not discharging to its full capacity.

This statement will, at first, appear paradoxical; but, on closer investigation, it will be seen that there is nothing strange in it. The discharge includes the other four factors, so that, in considering this matter, each must be separately dealt with. Referring to the figures and tables, it will be seen that, although both the area and the wetted perimeter which make up the hydraulic mean depth, attain their greatest value when the sewer is full, the increase in the value of the wetted perimeter is much more rapid towards the end than that of the area; consequently, the resulting hydraulic mean depth is less than when the difference in the values of the two factors is greatest in favor of the area. This, of course, entails a reduced velocity, and consequently a less discharge than when a greater velocity is multiplied by a slightly less area. In addition to simplifying calculations for velocity and discharge, the tables will be most useful in determining the depth of flow in any sewer due to a given discharge, and the heights of weirs and storm overflows.

Condensed Table for Circular Sewers.

Proportionate Values at each Depth.

Proportions of Depth of Flow.	Area	Wetted Perimeter	Hydraulic Mean Depth	Velocity.	Discharge.
0	0	0	0	0	0
.05	.019	.141	.135	.367	0.07
.10	.051	.201	.255	.506	.026
.15	.094	.249	.376	.613	.057
.20	.141	.291	.484	.696	.098
.25	.194	.329	.588	.765	.148
.30	.252	.366	.688	.828	.208
.35	.311	.400	.776	.884	.275
.40	.373	.431	.864	.929	.347
.45	.435	.463	.940	.968	.421
.50	.500	.500	1.00	1.00	.500
.55	.564	.533	1.056	1.028	.580
.60	.627	.565	1.108	1.053	.660
.65	.688	.600	1.148	1.069	.736
.70	.748	.634	1.180	1.085	.812
.75	.806	.670	1.204	1.094	.882
.80	.859	.708	1.212	1.100	.945
.85	.906	.750	1.208	1.097	.994
.90	.949	.799	1.184	1.088	1.032
.95	.981	.859	1.140	1.066	1.046
1.0	1.00	1.00	1.00	1.00	1.00

Condensed Table for Egg-Form Sewers.

Proportionate Values at each Depth.

Proportions of Depth of Flow.	Area	Wetted Perimeter	Hydraulic Mean Depth	Velocity	Discharge
0	0	0	0	0	0
.05	0.16	.100	.161	.400	.006
.10	.043	.148	.290	.540	.023
.15	.077	.193	.399	.630	.048
.20	.119	.238	.503	.708	.084
.25	.163	.277	.591	.766	.125
.30	.213	.317	.668	.816	.174
.35	.268	.357	.751	.866	.232
.40	.326	.397	.818	.906	.296
.45	.387	.436	.886	.939	.363
.50	.450	.476	.943	.971	.438
.55	.511	.514	.990	.993	.507
.60	.580	.553	1.046	1.021	.592
.65	.638	.591	1.077	1.036	.661
.70	.702	.629	1.114	1.054	.739
.75	.766	.668	1.145	1.068	.819
.80	.829	.709	1.166	1.079	.895
.85	.886	.752	1.176	1.083	.960
.90	.937	.801	1.166	1.079	1.011
.95	.978	.862	1.169	1.053	1.027
1.0	1.00	1.00	1.00	1.00	1.00

The following examples will illustrate the method of using the tables:—Suppose it be required to know the discharge, etc., of any sewer at a given inclination at various depths of flow. Instead of having to make separate uses of the same formulas

*By Robert Maynard Gloyne, Assoc. M. Inst. C. E., in excerpt minutes of Proceedings of the Institution of Civil Engineers. The diagrams accompanying this paper are omitted, as each engineer can easily construct them for himself.—Ed. Eng. News.

for each depth, it is only necessary to obtain by them the discharge, etc., when full, the required information at the other depth being obtained by multiplying the value so found by the vertical figures at the top of the tables, which correspond to the depths at which the information is required.

Example:—Required the discharge of a culvert 10 ft. in diameter, at a fall of 2 ft. per mile when running one-quarter and three-quarters full. By formula, the discharge when full is found to be 13,658.89 cu. ft. per minute, and this value multiplied by 0.148 for the quarter, and by 0.882 for the three-quarters, will give the required information:

$$13{,}658.89 \times 0.148 = 2{,}021.53$$
$$13{,}658.89 \times 0.882 = 12{,}047.14$$

cubic feet per minute, corresponding to the respective depths. Again, suppose that it be required to know the depth to which discharges of 2,021.53 and of 12,047.14 cu. ft. per minute will respectively fill the same sewer, or the heights of the weirs necessary to stop and turn these discharges, the one operation giving either or both results. Having obtained, by formula, the discharge when full, it is only necessary to divide the given quantities by that value, and to find the ordinates corresponding to these results, at the feet of which are the depths required. For instance, $2{,}021.53 \div 13{,}658.89 = 0.148$, and tracing the ordinate corresponding to this to its foot, a value 0.25 is found, thus giving a depth due to the assumed flow, or a height of weir necessary to turn that flow, of one-quarter the full dimension, namely, 2 ft. 6 ins. Similarly, dividing 12,047.14 by 13,658.89, a result 0.882 is obtained, and again tracing the corresponding ordinate to its foot, a value 0.75 is found, giving a depth of flow, or height of weir, of three-quarters the full dimension, or of 7 ft. 6 ins.

Thus, by the employment of these tables in such calculations, the repeated use of the same formulas is obviated, and a considerable amount of time gained.

The paper and tables are submitted as a continuation of those on the "Discharges of Circular and Egg-Form Sewers," by Mr. W. T. OLIVE, Assoc. M. Inst. C. E. [1]

[1] Minutes of Proceedings Inst. C. E., vol. xciii. p. 383.

Alteneder's Patent Joint Compasses, with Micrometer Adjustment.

The illustration shows an instrument with interchangeable pen, pencil, and lengthening-bar, and having a hair-spring attachment to needle-point leg. This may be used either for correcting any slight inaccuracy in setting the instrument or for drawing parallel circles at minute distances apart. It is a refinement which aids materially in accurate work, is useful in ordinary work, and does not detract in the least from the stiffness and reliability of the tool.

Alteneder's Patent Joint Compass.

With this adjustment, the pencil or pen can be set accurately without removing the needle-point from the paper, thus overcoming the difficulty often experienced in drawing arcs perfectly concentric to each other, or tangent to a straight line, as well as arcs of precise radius or passing through an exact point. The operation is as follows: Adjust the thumb-screw until the spring is in a position somewhere near the center of its movement, in order to allow for adjustment in either direction; place the needle-point at the given center, open the legs approximately to the point through which the circle is to pass, then with the other hand and without removing the needle-point from the paper, turn the thumb-screw to the right or left, in order to bring the pencil or pen precisely to the point required. The accuracy and rapidity of adjustment thus attained, without sacrifice of rigidity in the tool or convenience in handling, is a valuable addition.

Another important advantage of this attachment is that it renders the instrument superior to anything else as a spacing divider; for this purpose, the lead is replaced by the extra needle-point. The knuckle-joints permit both needles to be set perpendicular to the paper, and the screw adjustment enables their distance apart to be regulated with the utmost exactness.

The pen is made of one piece of steel without any joint between the blades, thus insuring that the points will always match and avoiding any possibility of side motion. The patent joint has a washer between the two bearing surfaces, which are clamped together by means of the conical points of two opposite screws carried in a head of German silver, the metal of which has been hammered to make it stiff and of reliable elasticity. This arrangement insures a uniform pressure and amount of friction in all positions of the legs of the instrument, so that when the joint is once adjusted to suit the requirements or fancy of the draughtsman, it will have the same tension in all positions and will retain it. This instrument is designed and manufactured by THEO. ALTENEDER, of Philadelphia, and each genuine instrument is stamped with his name.

The Charlottetown, Prince Edward's Island, Water-Works.*

Charlottetown has a population of about 12,000. It is situated near the junction of the North and Hillsborough rivers, on gently rising ground, the highest point having an elevation of less than 50 ft. The geological formation at this point is of new red sandstone, containing many fissures, through which surface water readily found its way to the wells which for many years were the only source of water supply. As the population increased, the well-water became more impure, and in 1871, when the population was about 9,000, water began to be brought to the city in carts, from "Spring Park," a well of considerable purity. The annual expense to consumers of water from this source was about $12,000.

In 1875, a general supply was discussed, and investigations to that end made by GILBERT MURDOCH, St. John, N. B., but no further action was taken until June, 1887, when a Commission was appointed which decided to test the gang-well system, and employed M. M. TIDD, of Boston, Mass., as engineer. Test wells were sunk near Three Mile brook, and plenty of water found. The drainage area of this stream is about 900 acres, and its valley is underlined, at from 18 to 20 ft., with a stratum of solid rock.

The examination warranting it, a large surface well was decided upon, from which water would be pumped to a distributing reservoir. If necessary, the supply could be increased by a dam across the brook, 8 ft. high, and also from Gates pond.

In excavating the well, sheet piling was used to prevent sliding of the adjacent earth, and two pumps kept the well free from water. Rock was reached at a depth of 19 or 20 ft., where a level foundation was prepared for the masonry lining, the first 13 ft., of which is of rough blocks of Nova Scotia grey sandstone, backed with broken stone. The lining is laid loose to allow water to enter the well. The upper part of the lining is of burnt bricks laid in Portland cement. The well has an overflow.

The pumping station is across the brook, of brick, the pump-room being 34 by 40 ft., and the boiler room, 28 by 34 ft. Sheet-piling was also used in making the excavation for the pumping station, and the foundations were built on 2 ft. of concrete. The pump-well walls are of brick in cement, and the pump foundations of stone masonry in cement.

The pumping engine is a Blake duplex, with inside plunger, 14 ins. high, and 28-in. low pressure steam cylinders, and 14-in. pump cylinder, all of 18-ins. stroke. The specifications require it to have a daily capacity of 2,000,000 galls., against a vertical head of 200 ft., through 4,722 ft. of 12-in. pipe, with a steam pressure on the boiler of 60 lbs. per sq. in. The usual accessories are provided. The boiler is horizontal, tubular, of C. H. No. 1 wrought-iron, ⅝ in. thick, with a tensile strength of 50,000 lbs. per sq. in. of section, tested to 150 lbs. cold water pressure. The shell is 16 ft. 2 ins. long, 72 ins. in diameter with 112 3-in. tubes, and 4-in. main steam connections.

From the pump to the reservoir there is a 14-in. force-main, 4,722 ft. long. The pipe is from Laidlow & Sons, Glasgow, Scotland, has hub and spigot joints, is in 12-ft. lengths, exclusive of sockets. It was required to have a tensile strength of 16,000 lbs. per sq. in., and to be coated inside and out with Dr. ANGUS SMITH'S preparation. The pipe is laid with the top 5½ ft. below the surface, and when necessary, on a concrete foundation. This description also applies, as to size and quality, to the supply main from the reservoir to the city, and probably, as to quality, to the distributing mains.

The reservoir is 135 ft. in diameter on the finished bottom, 186 ft. on top at inside line of embankment, and 17 ft. deep. The general width of the embankment on top is 15 ft., and the slopes are 1½ to 1. The reservoir is in excavation and embankment, the portion excavated approximating in amount to the contents of the embankment.

The base of the embankment was carefully prepared, and the embankment carried up in 6-in. layers, carefully rolled with a grooved roller, watered as was necessary. When the embankment had been carried to a vertical height of 8 ft. the bottom of the reservoir was leveled and smoothed, and covered with 4 ins. of clear sand. Over this and upon the inner slope of the unfinished embankment, and over its top to 1½ ft. past its center, is placed 2 ft. of clay puddle, composed of pure, adhesive clay, mixed with clean gravel in proportions determined by the engineer. The materials were mixed dry, then wet and mixed further, and finally applied in 6-in. layers, each layer being allowed to become firm, but not too dry, before the next was applied. On the puddle carried over the top of the unfinished embankment, and 6 ins. from the edge of the puddle, a 2-ft. cave wall was carried up for 6 ft. It is of rubble masonry, in mortar composed of one part of Portland cement to two of clean, sharp sand, and is plastered on the inner face. After this wall was completed the embankment was finished, its inner slope dressed to a true line, and 9 ins. of broken stone laid on and rammed to place. The inner slope was then paved with stone averaging 3 x 3 x 1 ins., laid dry, as close as practicable. The lower course has a footing of concrete, was laid in cement mortar, and extends the full depth of the paving and broken stone backing. The gate-house and screen-well are of hard burnt brick, the walls of the latter being 16 ins. thick, on 18 ins. of concrete.

The elevation of water in the reservoir, when full, is 150 ft. above tide level.

There are 15,767 ft. of 14-in. 6,767 of 10, 9,645 of 8, and 49,044 of 6-in. pipe, or a total of about 15 miles.

The estimated cost of the complete system was about $150,000. As stated, the works were designed by M. M. TIDD, Boston, Mass. The Constructing Engineer, C. F. COFFIN, Boston, was assisted by J.P. BALL.

*Abstracted from a paper read before the Charlottetown City Council, Nov. 29, 1888, by S. R. LEA, Student Can. Soc. C. E.

The Chignecto Marine Railway.

The official prospectus of the Chignecto Marine Transport Railway Company, lately published in London, gives the following data relating to the affairs of this company.

The subsidy from the Dominion of Canada is $170,602 annually for 20 years from the date of opening of the line. The share capital of the company is $1,500,000 in preferred shares and $570,000 in ordinary shares. Both classes of shares are entitled to a cumulative dividend of 7 per cent. per annum, and any available surplus profits are to be divided pro rata. The company is alse authorized to issue $3,500,000 in 5 per cent. mortgage debentures. Mr. Thomas Wood, of 36 Old Broad St., London, is President of the company, and the engineers are Sir John Fowler and Mr. Benjamin Baker, of London, and Mr. H. G. C. Ketchum, of Fredericton, N.B.

The purpose of the company is to construct a railway, 17 miles long, to transport ships across the isthmus of Chignecto, connecting Nova Scotia with the rest of the Dominion. The contract was entered into on March 4, 1886, between the Canadian Government and the company, and by its terms the company is to construct and equip the railway with hydraulic lifts capable of raising and transporting over the line ships of 1,000 tons register with full cargo, and to construct docks at each end capable of holding six vessels. The hydraulic lifts will be somewhat similar in design to those used in the Victoria Docks, London, and in Malta and Bombay. The ships when raised will be transported on the same cradles in which they are lifted over the railway, provided with four lines of rails. The line itself is perfectly straight and nearly level.

The tonnage in 1888 entering and leaving the ports immediately affected by the marine railway was 10,182,327 net tons. Taking 800,000 tons, or one-twelfth of this only, the estimated revenue of the company would be $500,000 annually at 2s. per ton for cargo and 6d. per ton for vessels' hulls. Mr. Baker estimates the working expenses, in full operation, with administration and office expenses added, at $150,000 per year. The time of completion has been extended to July 1, 1890, with the privilege of a further extension of two years, subject to a payment to the Government of $5,000 per month. The contractors are John G. Meiggs & Son, contractors of large experience in the Argentine Republic and other parts of America.

$25,000 for the loss of a leg brings up the aggregate for "a total loss" of the human body to a pretty stiff figure. But a jury in the Supreme Court, Brooklyn, has just given a verdict for this amount to an employé of the Phœnix Bridge Co. who had his leg crushed during the construction of the Kings County Elevated Railroad.

The New York Rapid Transit Bill, as now before the Legislature, is being made to forward the plans of both arcade and cable-road promoters. It contains a section providing that Broadway shall only be used for an underground road, specially forbidding any elevated structure. Another provision in the bill partially recognizes the existence of the Cable-Road Commission. The bill is made a special order for next Wednesday.

The Hudson Bay Railroad project dies hard. The Manitoba Legislature having repealed the act offering a guarantee upon $4,500,000 for twenty-five years in aid of the scheme, and reducing the aid to a cash subsidy of $600,000, the promotors of the project are now seeking to induce the British Government to interfere and disallow this legislation, on the ground that vested interests had been created on the strength of promised aid. The imperial Government has heretofore persistently refused to interfere, and the provincial Legislature is not likely to make a new departure now.

The dry-dock at the Gosport navy-yard is to be completed in May next. The new dock is built on the Simpson system and is 500 ft. long, the same in length as the one now building at the Brooklyn navy-yard. A similar dock is to be built at the League Island navy-yard in Philadelphia.

The West Chicago Street Railway Company has secured a permit for building a tunnel beneath the river to connect the west and south sides. The new route will avoid the present delays at the draw-bridges.

Passenger Ferry Bridge.

(WITH INSET CUTS)

An interesting and instructive history could be written marking the steps in the evolution of ferry and freight bridges or pontoons. This account should be supplemented by a description of the various modifications introduced by engineers engaged in designing these structures. In the case of freight bridges, this article would be so voluminous as to warrant its appearance in book form, as we find there is unanimity of opinion only upon a few points. There may be said to be no common practice. This is not the case with ferry or passenger bridges, since the principal features are found in all the bridges lately built, the difference being mainly in the details.

We herewith present complete working drawings of a ferry bridge designed for the New York, Lake Erie & Western Railroad and erected at its Jersey City ferry. The bridge is composed of two bow string trusses of 60 ft. 1 in. span from end to end and two latticed side trusses. The bow strings are spaced 12 ft. 4 ins. center to center, the carriage-way between the wheel guards being 10 ft. The foot walks are 8 ft. in the clear. The top chord of the bow strings consists of five pieces 3×12 ins., the bottom chord being a single piece 12×12 ins. The posts are 12×12 and are placed 8 ft. 6½ ins. center to center. In the side trusses are ten panels 5 ft. 3 ins. The transverse floor beams are 10×14 ins. and are supported by 1⅛-in. rods extending through the top chords of the bow strings, and by 1-in. rods extending through the bottom chords of the side trusses. The stringers, of which there are thirteen spaced as indicated on the drawing of the floor system, are 6×15 ins. On these is a double floor of 3-in. planks. The floor is 64½ ft. in length over all and 37¼ ft. in width.

The shore end of the bridge rests on bearings formed as shown in the side elevation.

The river end is supported by a pontoon 34½ ft. long by 13 ft. wide at the top. The ends are vertical as is the front to a depth of 5 ft. The lower part of front—7¼ ft.—and the shore side—12¼ ft.—meet at an angle of about 85°. The ten frames of the pontoon are of 6×8-in. timbers placed at equal distances apart, stiffened by 6×8-in. struts, the angles being strengthened by knees. The whole is sheathed with 3-in. planks, the front having an extra sheathing of 2-in. spruce.

This form of pontoon is now generally used both for ferry and freight transfer bridges, as it possesses marked advantages over the old rectangular float. One of the most essential advantages arises from the fact that, owing to the triangular bottom, the buoyancy of the pontoon increases rapidly as it sinks, and is therefore better adapted to support widely varying loads. The depth to which the bridge will sink under a heavy load (when the river end is not supported by the toggles resting on the boat) is not so great as in the old form. A great and troublesome feature with the old style of pontoon was that the ice being forced by the water under the float, raised it to such a degree as in some cases to prevent the unloading of the boat; the bottom of the present float forms a wedge under which the ice cannot pack.

The ends of the horns of the curve of the river end of the floor of the bridge are supported by 10½-in. I-beams, 18 ft. long. These beams extend back the entire width of the pontoon upon which they directly rest.

The form of the gallows frame and the dimensions of its several timbers are given in the drawings.

A New System of Propelling Vessels.

It will be remembered that we noticed last year some very successful tests on a small scale of a new system of propulsion by a hydraulic jet, the novelty of the system consisting in the use of very small jets projected at very high velocities under enormous pressure, instead of the older plans, which are very old, of projecting a large jet at low velocities. A new and much larger craft, the *Evolution*, is now well advanced toward completion, the designer of the machinery and inventor of the system being Dr. Walter M. Jackson.

The first craft, the *Prima Vista*, a quite small boat, made from 18 to 20 miles an hour for a short distance, with a hydraulic pressure of 800 lbs. per sq. in., when she broke down. Mr. E. E. Roberts, late of the Engineer Corps, U. S. N., in speaking of this new method of propulsion, says that his first impression of the *Prima Vista* was a tendency to mirth, only checked by regard for the doctor. But this, was changed to astonishment when the lines were cast off and the boat commenced to move. "To the best of my recollection, the nozzle which drove the *Prima Vista* was only ¼-in. in diameter, flared to ⅝-in. I had sold the boat to Dr. Jackson, and knew what she was capable of with the machinery I had put in her; but the hydraulic jet propelled her at a rate equal to the fastest time I had seen her perform with marine engine propulsion."

The new vessel is 100 ft. long over all, has a beam of 25 ft. and a depth of 7½ ft. Her floor is nearly flat, with a rise of only 2 ins. in 7½. Her lines are sharp; her hull is built of cancellated white cedar, and her keel is of solid white oak. She has two water-tight bulkheads, a forward cabin, pilot house, etc. Her boiler is of the Roberts type, with three steam drums, each 15 ft. long and 20 ins. in diameter. The boiler is 15 ft. square, composed entirely of welded steel tubes, all the angles, return bends, etc., being made of aluminum brass. The pumping engine is 35 ft. long, of the compound duplex type; has low pressure cylinders, 44 ins. in diameter; high pressure 24; and a stroke of 3 ft. It is calculated that the engine will be able to afford a capacity of 1,000 galls. of water a minute, driven out under a pressure of 2,500 lbs. per sq. in. She has two outlet nozzles, one at the bow, the other at the stern. The size of these nozzles is ⅝ in. Both nozzles are constructed so they will turn to an angle of 23½° either way and can be closed or opened instantly at any point of the sweep. They are connected to the pilot house, thus placing the whole propulsion and manœuvring mechanism of the vessel directly under the control of the pilot.

Dr. Jackson claims that from the pilot house the vessel can be reversed instantly, guided and steered at will, slowed up, stopped, or put on full speed, all without a signal to the engine room. At full speed he claims she can be swung broadside to the port, and can be stopped when under full headway almost instantly.

Her weight, including hull, boiler, engine, water, furniture, rigging, supplies, and crew for a 24-hour continuous run, will be about 100 tons. As she displaces about 6,000 lbs. to the vertical inch, this will give her a draught of 33 ins. She stands while at rest a little down by the bow, but when under full speed it is calculated that she will run on an even keel. By means of the hydraulic jet, Dr. Jackson claims that greater speed can be obtained with a certain horse power than if the same horse power were applied to a screw.

It is calculated that the *Evolution* will require 60 H. P. for a speed of 10 miles per hour, 400 H. P. to drive her 20 miles an hour, and 1,500 H. P. to give her a speed of 30 miles an hour, and 1,500 H. P. is the designed development of her engines.

Many very competent persons think that the experiment is one of much promise.

Proposed Consolidation of Boston Departments.

A report has been made to the Board of Aldermen of Boston, Mass., by a committee on the consolidation of city departments, favoring the passage of a bill establishing a board of public works to be known as "Commissioners of Streets."

At present the construction and maintenance of streets is in the hands of the following departments:—The Board of Street Commissioners, who lay out the streets; the Paving Department, which constructs, paves, and repairs the streets; the Health Department, which cleans them and the sewers; the Lamp Department, which keeps them lighted; the Sewer Department, which constructs and repairs main sewers and drains; and the Bridge Department, which has the care, maintenance, and repair of bridges. These departments are separate and distinct, and the work of each is to a great extent carried on independently and without reference to that of others. The committee summarize the faults of the present system as follows: I. Want of co-operation between the departments. II. Want of economy in obtaining supplies and employing labor.

The committee then recommended the consolida-

tion referred to, as a remedy, and presented the following bill:

Sec. 1. The Mayor of the city of Boston shall appoint, subject to confirmation by the Board of Aldermen, a board of said city to be known as the "Commissioners of Streets," to consist of three able and discreet men, inhabitants of said city, selected with reference to their qualifications for the due discharge of the duties of said office, and appointed, one for the term of three years, one for the term of two years, and one for the term of one year, from the first day of April in the year 1889, and annually thereafter, one for the term of three years from the first day of April, in the year of his appointment. Any vacancy occurring shall be filled by the appointment of a commissioner for the remainder of the term. Said board and the members thereof shall be subject to the provisions of chapter 266 of the acts of the year 1885, relating to officers and boards, and shall each receive a salary of $6,000 per year.

Sec. 2. Said board shall purchase all materials, employ all labor, and do all work required in (1) constructing highways and bridges, (2) keeping highways, private ways, and bridges clean, in good repair, and well lighted, and collecting and removing all offal, ashes and refuse matter from lands and buildings, (3) making and maintaining drains and sewers, (4) maintaining and operating ferries and bridges and draws in bridges, and (5) shall hold and exercise all the power and authority now held by the Board of Aldermen of said city, relating to ordering specific repairs on highways, and making assessments for benefits received from the making or repairing of main drains and common sewers, and all the powers and authority now held by the Board of Street Commissioners of said city; and said board shall have power and authority to make and enforce all regulations it deems necessary for the preservation of the cleanliness of the streets, courts, and passageways of said city.

Sec. 3. Said board shall not expend (1) for salaries, (2) for laying out, locating anew, altering, widening and discontinuing highways and bridges, (3) for constructing new streets and bridges (4) for keeping highways and bridges clean and in good repair, and removing refuse matter, (5) for making and repairing main drains and common sewers, (6) for maintaining and operating ferries, bridges and draws, a greater amount for each of said purposes than the said city shall specifically appropriate therefor.

Sec. 4. Said board shall appoint a clerk, who shall not be one of the commissioners, and such other subordinates as they deem necessary, and fix their compensation, and may remove the same at pleasure. Said clerk shall have charge of the records of the board, and shall perform such clerical and other duties as said board shall require, and shall be sworn to a faithful performance of the duties of his office; and, in his absence, a clerk *pro tem.* may be appointed by said board, to serve at its pleasure.

Sec. 5. No person shall hereafter open or make any excavation in any street or highway in said city, except for posts, and for rails and appliances of street railway companies; but said board may, on the application of any person or corporation authorized to place or maintain any structure under or upon a highway, break the surface and make such excavations in highways as shall be necessary for such structures, and said board shall refill and resurface such highways.

Sec. 6. The person or corporation for whom such excavations are made shall pay for the work of making and refilling such excavations and resurfacing the highway such sums in such manner as said board shall deem just and reasonable.

Sec. 7. The city engineer and city surveyor shall respectively furnish such surveys, plans and estimates, and perform such other duties pertaining to their offices as said board may require.

Sec. 8. This act, so far as it relates to the appointment of said commissioners, shall take effect upon its passage; and for all other purposes shall take effect on May 1, 1889, and on said day the Board of Street Commissioners of the city of Boston shall be abolished.

Alderman Murphy asked that the matter be assigned to the next meeting, at which a minority report will probably be presented The motion prevailed.

Running Trains on Time.

The *Constitution*, of Atlanta, Ga., has recently adopted the plan of publishing daily a list of the trains running into that city which arrive behind their schedule time; and in connection therewith makes some common sense remarks on the subject of late trains which we abstract as follows:

The duty of the railroads to the traveling public is clear. It is simply to deliver passengers promptly and surely on the advertised time.

The speed of a train—the number of trains—these are matters of convenience and are regulated by the desire to get travel. But to put a passenger where you advertise to put him, and exactly when you advertise to put him there, is a matter of contract, and it rests on a solemn obligation. The passenger rests everything on this. To meet a business engagement, to go to a death-bed, to close a contract—the most serious affairs of life—are rested on the printed pledge of the railroad that at a certain time, it will deliver its passengers at a certain place. This pledge it is bound to keep. An accident may prevent once in a year, or once in a month, and the road be held blameless. But when there is frequent and avoidable failure to keep this contract with the public, a railroad deliberately fails in its duty.

If its advertised schedule is a faster one than can be regularly and reasonably run, more time should be given. If more trains are dispatched than can be promptly delivered, the number should be reduced. The public may criticise slow or infrequent trains, but if the road keeps its advertised promise of delivery, its integrity will be maintained and it cannot be hurt. The public too, had rather travel in ordinary trains that "get there," than in "Fast Mails" that are slow, or in "Cannon Balls" that go astray, or "Through Limiteds" that find their limit before they get through.

It is argued that a train is frequently compelled to wait for a connecting train that is behind. When, except in extraordinary cases, a train waits for a connection longer than it can reasonably recover, it simply transfers and extends the dislocation. There are some trains that never wait longer than can be "picked up," and you may notice that their connecting friends are usually on time. Let the Atlanta trains adopt that rule. Every broken connection will emphasize the error or accident back of it, and locate the division superintendent who is unfortunate or to blame. And both errors and accidents will grow less frequent.

At any rate THE CONSTITUTION will continue its work in behalf of the public. If we cannot correct the looseness and inefficiency undoubtedly proven, we shall at least show the public which roads may be relied on to keep their advertised promise, and those which cannot. We do not insist on being hurled through space like comets or shooting stars, but we do insist on being transported with reasonable accuracy and promptness. And somehow or other, we believe our insistence will not be long in vain!

The Fell System on the Rimutaka Incline, New Zealand.

A paper lately read before the Institution of Civil Engineers is entitled "Further Information on the Working of the Fell System of Traction on the Rimutaka Incline, New Zealand," by Mr. JOSEPH PRIME MAXWELL, M. Inst. C. E. The author had given an account, in 1880, of the working of the Rimutaka incline, then but recently opened. In the present communication he submitted some additional data of working the Fell system, especially as the incline, which was on a gradient of 1 in 15, had many 5-chain curves, which were traversed with great facility. The traffic over the incline both ways for the year ending March 31, 1888, was equal to 50,000 tons of net paying load, the passenger tonnage being calculated proportionately to the non-paying load carried, as compared with goods tonnage. The cost of locomotive power for this service was equal to 4d. per ton of net paying load per mile. This might seem a high rate, but labourers on the New Zealand Government Railways were paid 6s. 6d.; gangers, 8s.; mechanics and smiths, 9s. to 10s. 6d. per day of 8 hours; drivers, from 10s. to 13s.; and firemen, 7s. 6d. to 9s. These rates in some instances were nearly double those in the United States, and still more in excess of European rates. The coal which cost 17s. 6d. per ton, had the following constituents: fixed carbon, 62.87 per cent.; hydrocarbon, 31.64; water, 1.66; and ash, 3.83 per cent.

Since the incline was opened, many improvements had been made in the details of the original Fell engines. These improvements were described. The gripping wheels were turned to the profile of the center rail. Sand between the rail and gripping wheels was not used, the wheels now giving ample adhesion. The vertical motion of the engine on springs being slight, the grooved gripping-wheels were not materially affected. Spherical crank pins had been substituted for the original straight pins, to allow for the gripping-wheels working out of the horizontal when turned smaller, or when drawn back from the rail. The original valve gear had been removed, and a simpler one substituted. The lead on the valves of the center engines, which caused a heavy knock on the geared wheels, had been much reduced, and geared wheels of cast-iron were acting satisfactorily. The Joy valve gear on the new engines worked well: after twelve months the wear was scarcely noticeable.

In descending the incline, steam was used in the cylinders for lubrication; and jets of water were played on the center rail, just in advance of the brake, to cool the rail and saturate the longitudinal sleepers, as a preservation against fire. The brake also lasted 3 times as long as when applied to a dry rail; water was also used on the trailing wheel tires, and it was found that the wear of rails and tires was considerably reduced by the free use of water, the train friction being reduced. Additional sand pipes had been fitted to the driving wheels. All coupled wheels were supplied with sand. When two engines were working a train, if the rails were greasy the leading engine with sand worked without much slipping; but the second engine slipped, unless the sand placed on the rails by the leading engine was washed off. This was done by a jet of water from the second engine, which placed fresh sand on the rails. The coupling gear of the regulator handles had been removed. When one engine slipped, steam was shut off both in the outside and the center engine, instead of the one only that was slipping.

All loads were now hauled; each engine was so placed as to haul its own load, and broken couplings were rare. Forty-five minutes were allowed between the stations for ascending goods trains with a gross load of 65 tons, exclusive of the weight of the engine; mixed ascending trains were allowed forty minutes, and a load of 60 tons. The distance was three miles. The center engine alone could take 40 tons up the incline, and the outside engine alone 30 tons. Trains were worked with one, two, or three engines, the engines being placed so as to divide the train, to prevent overstraining the drawbars. The traffic was somewhat intermittent, which increased the cost of working. The low speed in ascending the incline, while it prevented wear and tear, economized fuel greatly, and lessened the risk of accident. The capacity of such an incline for traffic would be limited, among other things, by its length.

An incline from 2 to 3 miles long, up which were conveyed loads of, say, 180 tons, with an allowance of an hour and a-half for the double trip, and with sufficient siding room at the foot and summit, was equal to an ascending traffic of 1,440 tons of gross load per day of twelve hours. A series of such short inclines, with suitable intervals to allow of crossing and watering, would evidently have the same capacity. For the year ending March 31, 1888, it was stated that the train mileage was 10,859; engine mileage, 15,020; consumption of coal per mile, 110 73 lb.; of oil per 100 miles, 3.98 quarts; of tallow, 0.95 lb.; and of waste, 4.64 lb. The total cost per engine-mile was 3s. 7.5d.

The Servis vs. the Perkins Tie-Plate.

In answer to the question raised by Mr. HARRIS, in our issue of March 23, concerning the relative merits of the Servis and Perkins tie-plates, we have had sent to us the following professional opinion of Mr. WM. BARCLAY PARSONS, an engineer of mature experience in the maintenance-of-way and well known to our readers from his series of articles on "Track" published in this journal. In answer to a communication from the Dunham Manufacturing Co., the makers of the Servis plate, Mr. PARSONS says:

You have referred to me the question of relative merits of the Servis and Perkins tie plates as commented on in ENGINEERING NEWS of March 16th and 23rd. It is both my opinion and the result of personal observation that the Servis plate is immensely superior to the Perkins, for the reason that it is firmly driven into the tie and becomes practically part of it; while the Perkins plate, which has the disadvantage of consisting of two parts, is free to move except as controlled by the spikes.

As to the question of the Servis plate cutting "grooves for local rot," that is an objection, as ENGINEERING NEWS says, which is not of serious moment. The channels of the plate being sharp, simply wedge apart the fibres which always are pushed against the iron to close the gap thus made, so that there is but little greater tendency to rot than there would be between adjacent fibres. A spike or piece of iron driven into wood does not tend within practical limits to cause rot; unless as ENGINEERING NEWS remarks, the rot be aggravated by motion, and then rot starts in the mashed fibre ends rather than in adjacent parallel and uncut fibres. The Servis channels being thin wedges, driven with the grain, separate, but do not cut the fibres.

The Perkins plate, on the other hand, is objectionable because:

(1.) The plate being detached from the tie does not of itself give any additional holding power.

(2.) The intermediate block of wood shortens the spikes the amount of its thickness and gives that much more leverage for the thrust against the rail to bend the spikes over.

(3) Shimming in winter, except by special means, is prevented. The spikes being already partly drawn, any additional blocking would be objectionable, and, except in small amounts, dangerous.

(4) Two wooden surfaces in contact form a most favorable condition for rot to commence and flourish, as evidenced by condition of abutting timbers in trestles or bridges.

THE BEE LINE has put into service, since Feb. 1, nearly 600 new cars. The ballasting of 60 miles of track has begun, and 50 miles of new steel rails are to be laid.

ENGINEERING NEWS

AND AMERICAN RAILWAY JOURNAL

Published Weekly at Tribune Building, New York.

VOL. XXI. Saturday, April 6, 1889.

D. McN. STAUFFER, A. M. WELLINGTON. EDITORS.

GEO. H. FROST. - - - - - BUSINESS MANAGER.

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Drawings for publication *should preferably be in plain black and white, considerably larger than they are expected to appear, with letters and figures in pencil only, all lines clean and bold.*

Coming Technical Meetings.

Engineers' Club, Philadelphia, Pa.—Regular meeting, April 6. Secy., Howard Murphy, 1122 Girard St.

Association of North American Railroad Superintendents.—Spring meeting, Apr. 8 at 46 Pond St., New York City. Annual election of officers. Secy., C. A. Hammond, 350 Atlantic Ave., Boston, Mass.

Civil Engineers' Club of Cleveland, O.—Regular meeting, April 9. Report on Applied Science. Secy., James Ritchie, Case Library Rooms.

New England Railway Club, Boston, Mass.—Regular meeting, April 10. "The Compound Locomotive." Boston & Albany passenger station.

Engineers' Society of Western Pennsylvania, Pittsburg, Pa.—Regular meeting, April 16. Secy., S. M. Wickersham, Penn Bldg.

Boston Society of Civil Engineers, Boston, Mass.—Regular meeting, April 17. Secy., S. E. Tinkham, City Hall.

American Society of Civil Engineers, New York.—Regular meeting, April 17. Secy., John Bogart, 127 E. 23d St.

Engineers' Club of St. Louis, Mo.—Regular meeting, April 17. "Sanitary Condition of the Water Supply of New York City." Prof. C. C. Brown; "Pavement Curves, Missouri Pacific Ry.," Willard Beahan. Secy., Wm. H. Bryan, 709 Market St.

New York Railway Club.—Next meeting, April 18. Rooms 113 Liberty St., New York City.

American Society of Mechanical Engineers.—The annual meeting will be held at Erie, Pa., May 14, 15 and 16. Secy. F. R. Hutton, 20 Broadway, New York City.

Western Society of Engineers, Chicago, Ill.—Regular meeting, May 1. Secy., John W. Weston, Gaff Building.

Engineers' Club of Kansas City, Mo.—Regular meeting, May 6. "Foundation for the Limtjord Bridge," Otto F. Sonne. Secy., Kenneth Allen, 310 Baird Building.

A LETTER from MRS. KUTTER gratefully acknowledges the receipt of contributions from Mr. GRAVES, of Colorado, the students of Princeton College, and several other late expressions of sympathy with the widow of Mr. WM. R. KUTTER. She says she does not know what she should have done but for "her generous and high-minded American friends," She is devoting most of the money sent her to the education of her children. Her address is Vineltz, near Eriach, Canton Berne, Switzerland, where she has a little *pension* and takes a few boarders.

THE attention of everyone having to do with water-works construction or maintenance is called to the forthcoming meeting of the American Water-Works Association, to be held at Louisville, Ky., on April 16, 17, and 18. The programme, elsewhere more fully noticed, includes papers on very live subjects from some of the best-known workers in the profession, and every indication points to a very successful and profitable meeting.

THE phenomenon which is to take place during the coming season in Oklahoma is one well worth watching, as a significant evidence of the all but complete subjection of this continent to civilization. This is the first instance in which tens of thousand of settlers have been waiting for land, and no land (deemed worth having) waiting for settlers. Only a small part of Oklahoma is to be opened to settlement this month, and it is said that over 20,000 men and families are actually in camp upon the border, waiting for the chance to fight with each other for the homesteads which will not be enough to half go round; but something like 23,000,000 acres, or enough to make a good-sized State, are to be opened to settlement very shortly; and unless all signs fail, it is probable that we shall see within the next 12 or 18 months what even this mushroom land has never seen before,—the creation of a State as if by magic, almost before the farm of the very first settler is decently broken. Two results are sure to follow: (1) The very rapid growth of at least one large town and perhaps many small ones, in which those who are lucky enough to be on the ground betimes and to "make no mistake" will be apt to find great chances both for investment and employment; and (2) a very rapid multiplication of railway lines within the area opened. Let any one look at our last railway map of this region and of the United States, and see what a network of lines has been constructed in Kansas, which is cut off abruptly by the Oklahoma line. The network is sure to extend quite rapidly through the opened territory, and those looking for employment this year will do well to keep their eyes on this region.

ONE further result may possibly follow, and in fact seems almost inevitable: with such intense pressure to get possession of these lands —almost the richest on this continent, and now only cultivated on the most limited scale by the Indians—there will be certain to be a vigorous and continued effort to have 160 acres each, more or less, allotted to the Indians in severalty, under suitable restrictions, and have all the rest of the land purchased from them and likewise thrown open to settlement; nor is it clear to us how this demand can be long resisted, nor why it ought to be. From one point of view, it seems a hardship that the original owners of the continent should not have this one little corner of it left in their possession undisturbed; but, after all, ought the power of the Government to be forever exerted to protect one Indian in the misuse or non-use of enough land to support in comfort a dozen or two white families besides his own? Whatever may be said of the past, the further perpetuation of the Indian tribal organizations will be, we are satisfied, a mistake, defensible neither on grounds of policy or equity. There is no longer room on this continent for the perpetuation of savage conditions of life.

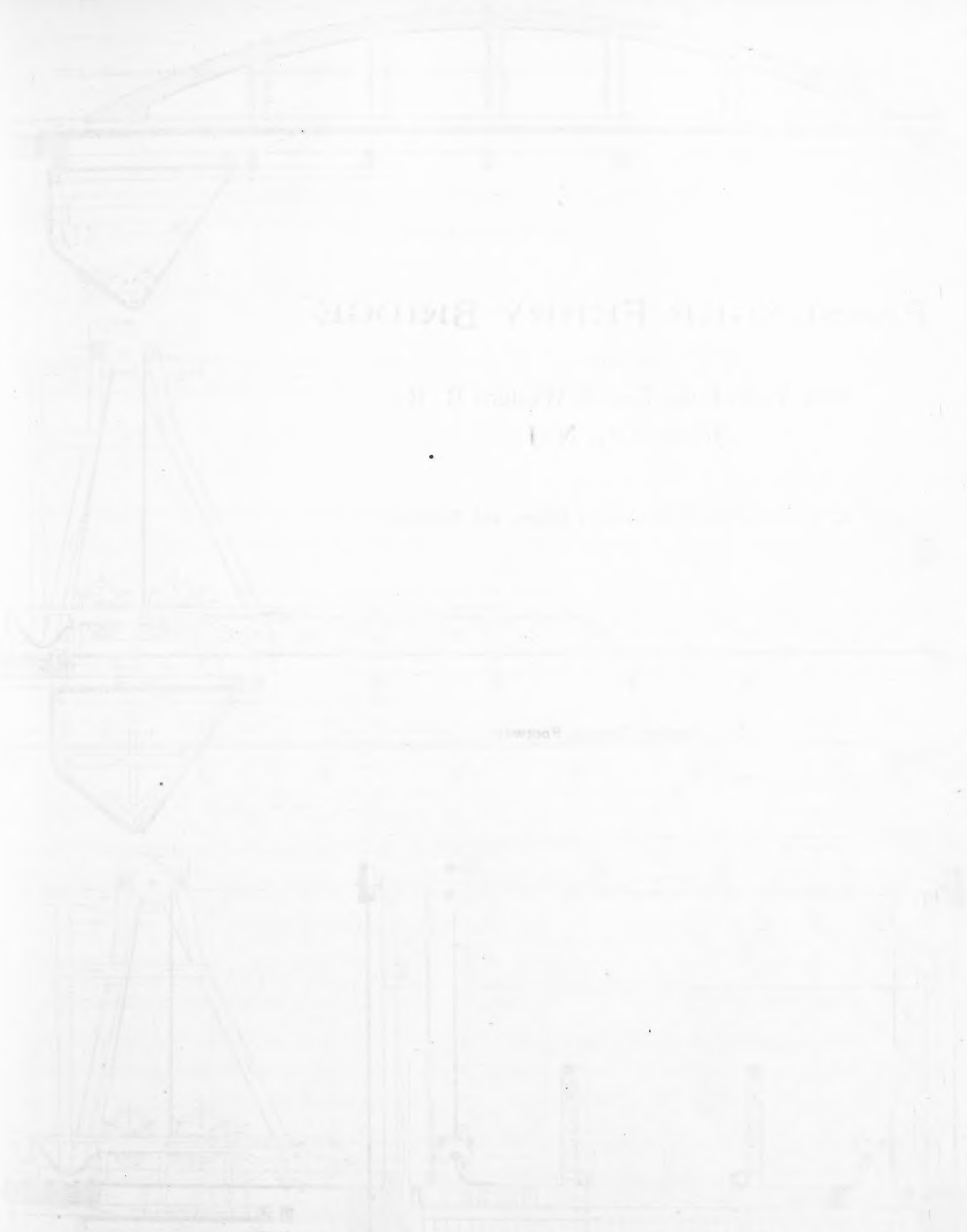
It is no true kindness to the Indians themselves. The true policy now is rather to give each Indian family a farm in severalty, making it inalienable for two or more generations, place the fair value of the other land taken from them for their benefit, with still further Government aid if necessary, invest them with the rights and duties of citizens as fast as possible, and then let them care for themselves. This policy, at least, is likely soon to prevail, and it will result in the settlement of three-fourths of Indian Territory by white people.

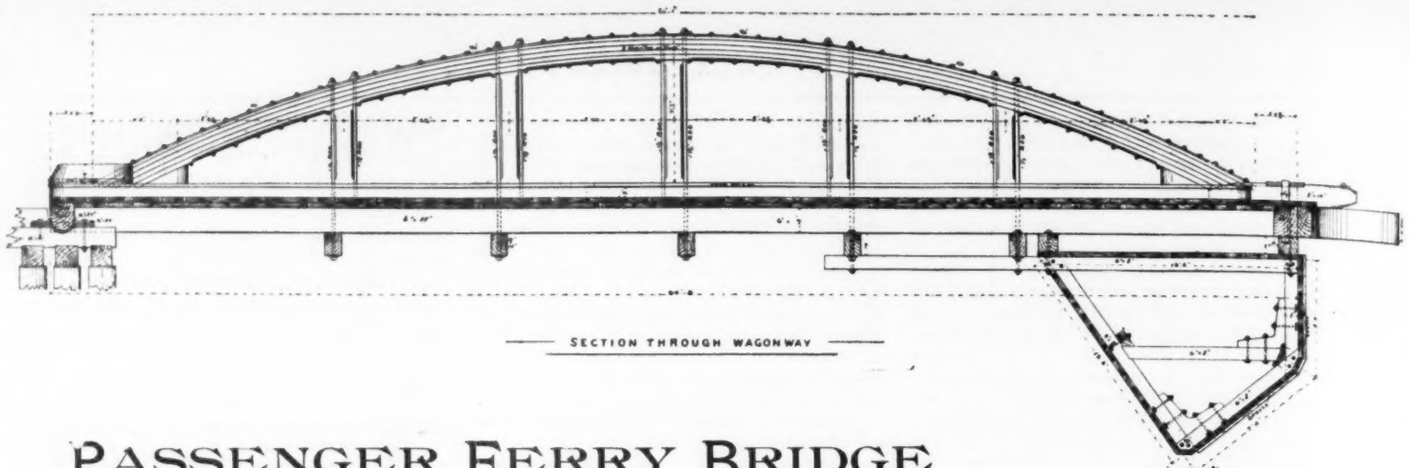
A STRANGE report has recently been made public that a company has been organized to build a railway through the whole length of the Colorado cañon, the cañon proper of which is some 200 miles long, about 5 miles wide, and sunk 5,000 ft. to 6,000 ft. below the surrounding country, so that the sources of local traffic would promise to be decidedly slim. The cañon also is exceedingly dangerous to go through now, throwing even the Royal Gorge of the Arkansas into the shade at many points. The project at first sight is not a very promising one, and the published names of the incorporators are not such, so far as they are known to us, as to inspire much confidence.

Nevertheless, although it may not be for many years, yet we think it extremely probable that the line will be eventually built, and likewise that it will prove to be reasonably profitable. In the first place, such cañon lines are never anything like as expensive as is expected. The Colorado cañon must be very different from all other long ones if there is not, for most of the way, quite a wide bottom, sufficiently high to put a line on even if not very wide; while in the narrower gorges, rock is at hand to make the roadbed of. Secondly, the grades would be very favorable. Thirdly, the route would be a tolerably direct one from Southern California—which is becoming an extremely important section, and is even anxious to set up as a State by itself—to Colorado, and with the one exception of the Marshall Pass, the line would be, not only direct, but low grade all the way from the Pacific coast to Kansas City. Fourthly, and most important, the attractions of the route as a passenger line would be very great indeed, especially as it would combine those of Colorado with its own. The Denver & Rio Grande now carries, because of its attractions in this respect, a good slice of the trans-continental traffic; except for its narrow gauge, it would carry much more. The last is likely to be changed, and the suggested new route would then be by far the most attractive one of its length on the continent, and would not be so very much longer, even to San Francisco, than the Central and Union Pacific.

PRESIDENT HARRISON, in appointing Capt. GEORGE R. WHITE, U. S. N., as Chief of the Bureau of Yards and Docks in the Navy Department, has doubtless selected an able naval officer for the position. But we must once again question the wisdom of putting a line officer of the navy at the head of what is really a civil engineering bureau. The President has simply followed long established precedent, a custom founded at a time when there were no civil engineers officially connected with the Navy Department. But as the real executive staff of this bureau has long been made up of engineers, it is time that the most experienced engineer in the bureau was put at its head. Such an appointment would be much more conducive to harmony in action and efficiency of service than anything that can be expected from the existing system. Under present circumstances, no President would dream of putting a naval officer in charge of harbor construction or river improvement, and yet such an appointment would be less absurd than the selection of a similar officer as the head of a bureau which has to practically deal with engineering structures on land. The engineering conduct of our public works very evidently needs remodelling all around.

THE fine run of the Strong Locomotive *A. G. Darwin*, which is more fully described elsewhere, will attract renewed attention to this most original and significant departure from established locomotive practice, the most original and the most significant that has been made since the days of the *Rocket*. The compound locomotive may seem an ex



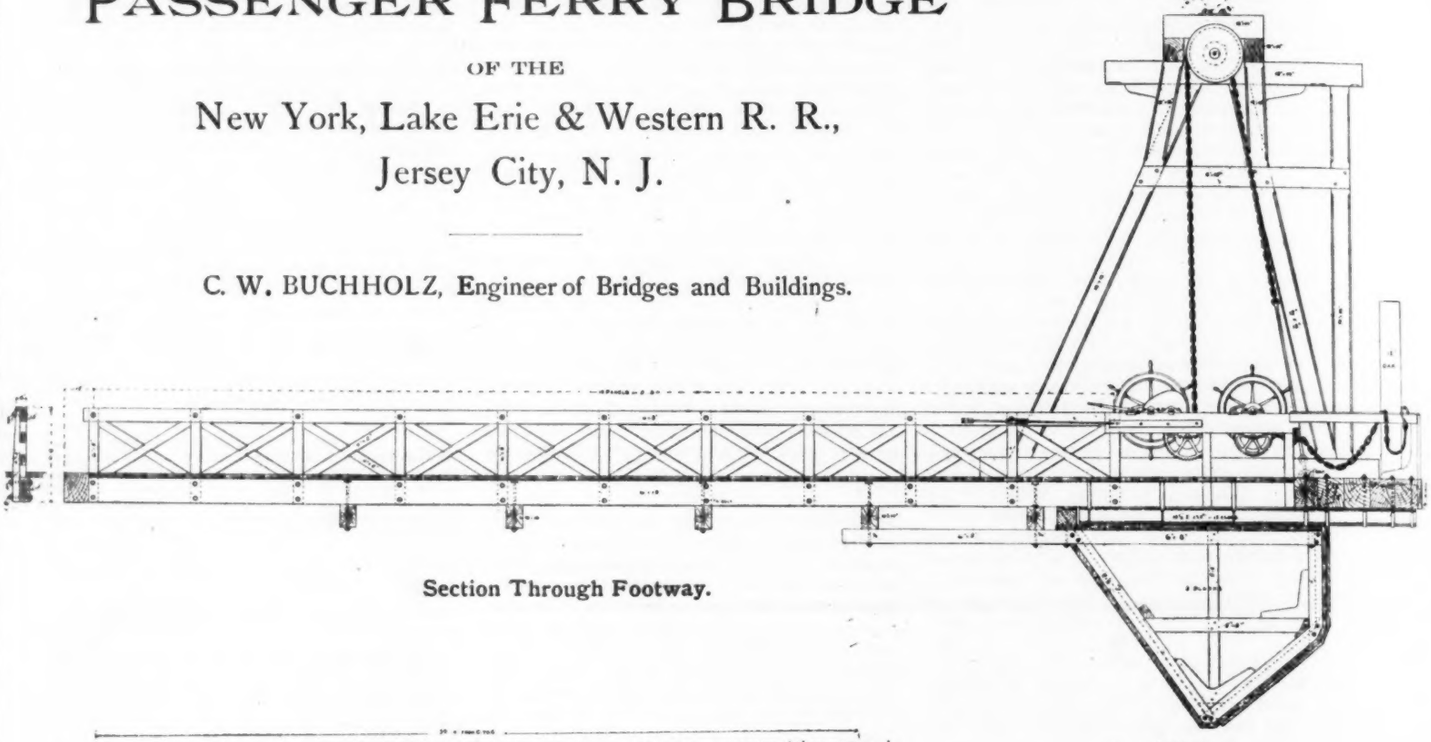


PASSENGER FERRY BRIDGE

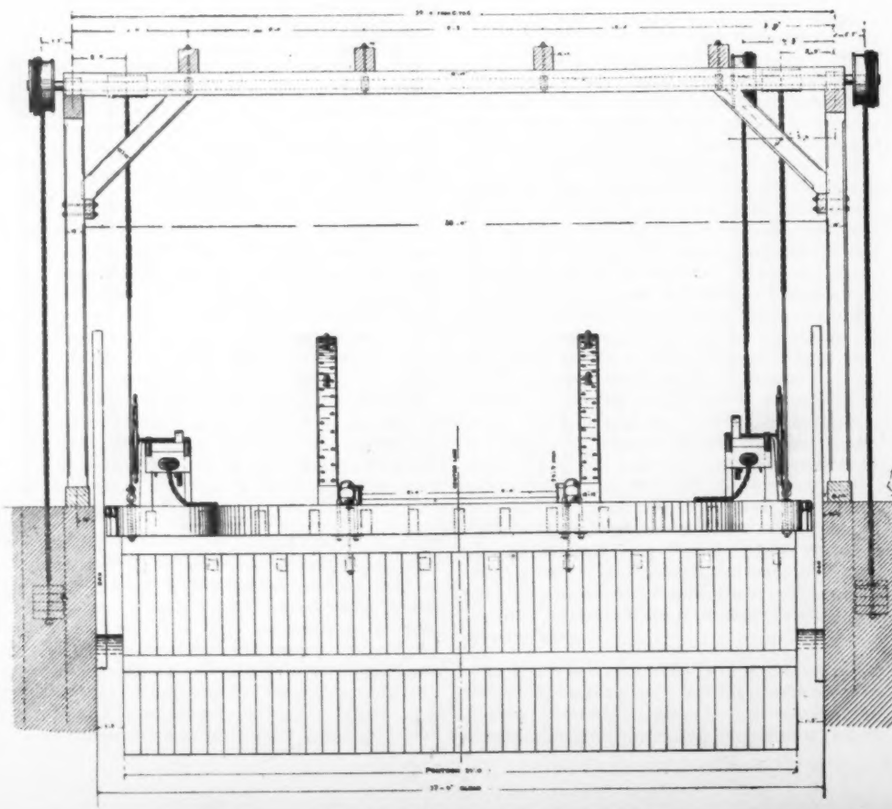
OF THE

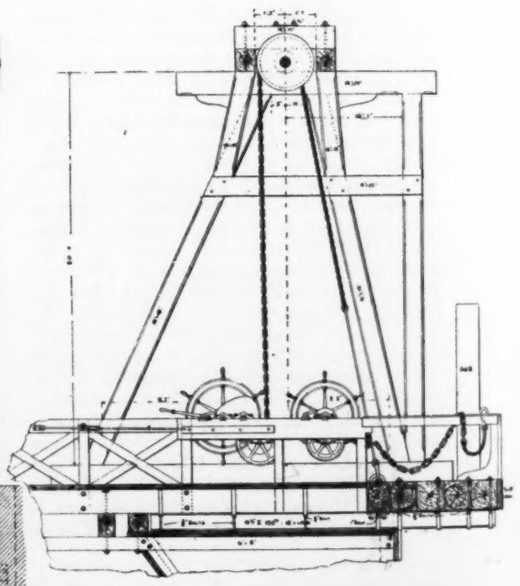
New York, Lake Erie & Western R. R.,
Jersey City, N. J.

C. W. BUCHHOLZ, Engineer of Bridges and Buildings.



Section Through Footway.

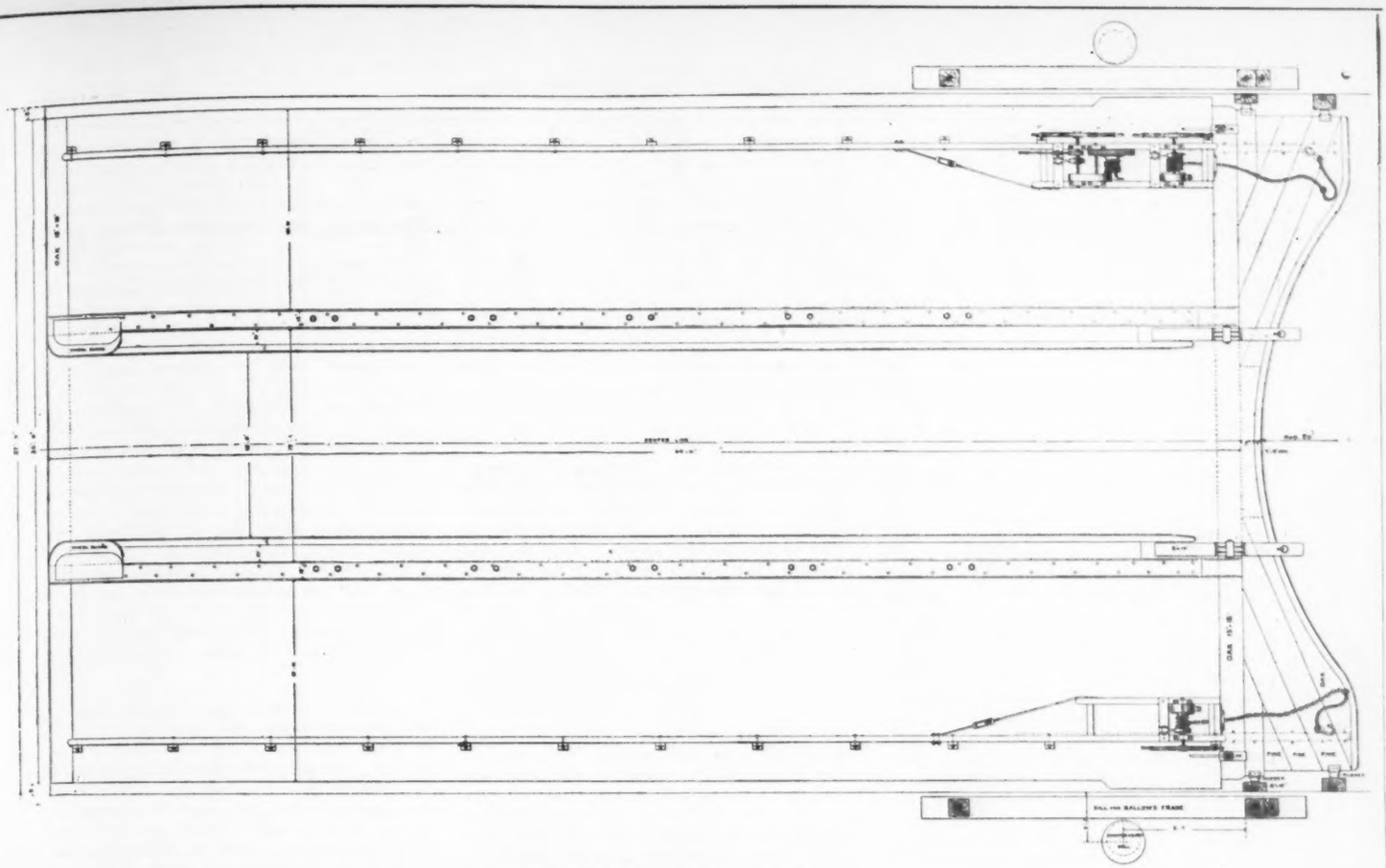




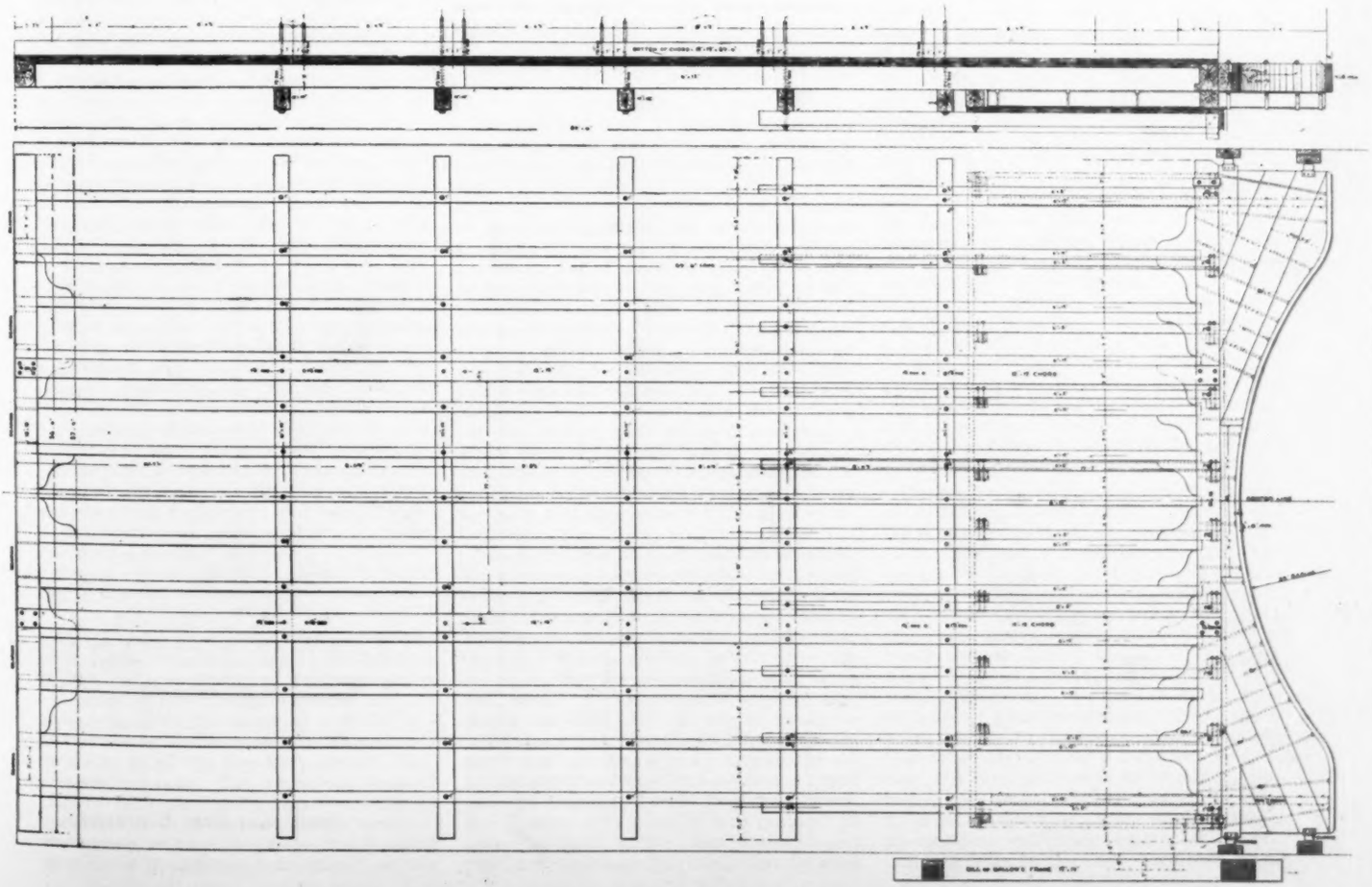
Front and Side Elevations

of

Gallows--Frame, Etc.



Plan of Bridge. Completed.



Section through Center and Plan, Showing Framing of Bridge.

ception, but that is only original as respects the locomotive, being a mere adaptation from marine and stationary practice.

The Strong locomotive, when hauling 9 cars, easily made 60 miles an hour for considerable stretches, and its double run of 846 miles in two successive days is certainly, from every point of view, a most creditable performance, and one almost without precedent, although no doubt, if it were worth while to make such runs often, there would be many more such precedents. The Strong locomotive, however, has two great advantages for such tests; its enormous duplex fire-box and large fire-box heating surface give great steam generating capacity, while its peculiar gridiron valves give such free and quick admission and exhaust as to enable the steam to be used much more economically. The engine, therefore, does not have to be pushed so hard to do the same work. The boiler and valve gear are really distinct improvements, having no necessary connection with each other, and may be considered independently on their merits; but the boiler, especially, we regard as a most promising improvement.

THERE are no records existing by which it is possible to estimate the number of main line frogs in the United States, but the average is probably one per mile, or say 160,000. On the trunk lines it will rise to nearly or quite two per mile, and throughout the northeastern quarter of the United States it will average fully 1½ per mile. From 10 to 100 or more main line trains per day run over these frogs, while many of them are not used for side-track or cross-over purposes more than once a week, and on some roads a full half of them not more than once a day.

It is obviously very unfortunate that an expensive, noisy, rough, destructive, and more or less dangerous break in the continuity of the main rails should be made for such infrequent use as this, when its only purpose is to let the flanges, which extend not 1½ ins. below the tread of the wheel, pass through the main rail. Even the "Lady from Philadelphia" might be expected to suggest that it might be possible to lift the turn-out track so as to carry the one train a day over the main rail instead of cutting a gap for over 100 trains, averaging many more cars, to jump over daily. It appears to us entirely certain that, as we have stated elsewhere, it is a mere relic of barbarism to cut the main rails so often at such heavy cost, and that it has been merely because there were so many other things to attend to, and a traffic growing so fast that it was difficult even to provide in advance the absolute necessities, that nothing heretefore has been done to provide some substitute for a frog which would carry the lead rail over instead of through the main rail. Such a device we illustrate elsewhere, the invention of a practical railroad man of long experience, and one which has already successfully withstood several years' practical test. There are few more useful and promising fields for experiment, in our judgment, than the extension of this test to other roads.

WHILE London has an underground railway of very considerable magnitude, and has long experience in its operation, Parliament does not seem to take kindly to subway plans, if we can judge by the reception accorded to a bill proposing to build an underground road on the model of the New York District Railway for Broadway. The opposition declared that the road connected with nothing, that its construction would disturb traffic in one of the busiest of London streets, that it would be ruinous to omnibus companies, that the bill did not provide for the rights of owners of abutting property, that it was an experiment, etc. It was admitted during the discussion that present London railways afforded the maximum of inconvenience with the minimum of comfort. After considerable debate, the friends of the bill finally succeeded in obtaining a second reading, and a reference to the Railway Committee. While some of the objections are absurd, others have a most familiar ring to American ears. The trouble is that it is an innovation, the thing most objectionable to the average Englishman. And while he admits practically that his deep underground road is not a perfect success, he objects to a new departure in the form of a subway immediately supporting the street surface. As the objection to our elevated system seems to be insurmountable in London, it is strange that the next best plan should meet with such opposition, especially when it provides for the disposal of sewers, water and gas pipe and electrical wires, besides the transfer of passengers. This disposal of "street furniture," and the resulting freedom from disturbance of the street surface, is the one chief argument in favor of subways as compared with elevated structures; and the increased comfort to those using well-paved and well-cared-for streets is some compensation for the inherent discomforts of underground travel. London streets are remarkably well maintained, and subways for sewer and pipe disposal are in high favor; and as rapid transit is badly wanted in that city, on some plan superior in convenience and comfort to the Metropolitan Underground, it would seem that the subway system, combining traffic with a provision for pipes, etc., was peculiarly well adapted to its needs and should be popular. New things move slowly in England, but it will be interesting to watch the outcome of this latest proposed innovation.

Railway Construction East of Chicago.

II.

We gave last week, in connection with the map, some account of the relative activity of construction, in the area shown, at present and 18 months ago; and also of the work in the States where construction is most active. On pages 293 and 294 of last week's issue and page 317 of the current number will be found a complete list of the various extensions and projects shown upon the map, including also those in Canada and Maine north and east of the map's limits and a few of the newest enterprises which seemed to call for some mention, but were not yet sufficiently developed to be shown on the map. It is of course true, however, that the enterprises shown upon the map are of every shade of importance: while some are purely local in their origin and effects, others are of much wider significance; and the interests involved in them are such that they deserve a much fuller description.

The enterprises of most importance in Canada are those which are projected and backed in the interest of the Canadian Pacific Company. The extension which at present excites most general interest is the line from London, Ont., to Windsor, opposite Detroit, on which the contractors are now grading. This is the line which, as will be seen by our map, closely parallels for the whole distance a double track line of the Grand Trunk Railway; and it was therefore strongly opposed by the English stockholders of both the Grand Trunk and the Canadian Pacific (See ENG. NEWS, Dec. 1, 1888). The new line will probably be ready for traffic by the close of the present year; and it is altogether likely that, by some close traffic arrangement with the Wabash, the Canadian Pacific trains will, in a not much longer time, be run into Chicago.

It is also generally believed that the Canadian Pacific system is to be extended at an early date to a connection with the important American systems centering at Buffalo, N. Y. The Niagara Central railway, already built from the Niagara river west to St. Catherine's, and surveyed from that point along the shore of Lake Ontario to Toronto, seems likely to furnish the desired outlet. A chief feature of this enterprise will probably be another bridge across the Niagara gorge. Rumor has had it lately that this was to be a suspension structure; but it seems much more probable to an engineer that a cantilever type of structure will be the one selected.

The proposed line from Claremont to Sudbury Junction, on the Sault Ste. Marie division, has been publicly discussed by the C. P. R. managers. They have declared their intention of building it, provided that at any time it becomes impossible to make satisfactory arrangements with the Grand Trunk managers for rates on through traffic over the Northern and Northwestern lines. The proposed line, however, would run for a good part of the way through a district almost as rocky, barren, and desolate as the country north of Lake Superior; and while the southern 50 or 60 miles might pay as a branch, the only reason why the construction of the whole line is likely to be undertaken is because it may become a sort of military necessity in the warfare of competition.

On the east, the Canadian Pacific managers have completed the new Short Line across southern Quebec and northern Maine to Mattawamkeag, on the Maine Central system, and through trains are to begin running between Montreal and St. John, N. B., early in the spring. The remaining section of the Short Line to be built by the Canadian Pacific is a line 113 miles in length, from Harvey, N. B., to Salisbury. The route for the line has been located, and as the work is to be rewarded by a Government annual subsidy of $63,400 for 20 years, it is very sure to be built within the next year or two. When this is completed, the distance between Moncton and Montreal will be 527 miles against 662 miles by the Intercolonial. The section of the Short Line across Cape Breton Island is being constructed as a Government work; but the progress upon it is not very rapid.

In Newfoundland the Government is now considering proposals for the construction of a line 250 miles in length, from St. John's north to Hall's Bay. The work will occupy at least two seasons. The line will run through the interior of the island, developing a region now entirely without railway communication, and said to be well settled and able to furnish considerable traffic.

The remaining work in the Eastern Provinces calls for no special mention. Many of the roads now in operation there have so disappointed the foreign capitalists who furnished the money for their construction that, aside from the work already under way, few projects for new extensions are agitated. In Quebec there is considerably more activity. The Quebec & Lake St. John Railway, running north from the city of Quebec, and the Quebec Central, running south, are both at work on extensions of some importance. The country north of the St. Lawrence river is as yet almost wholly without railway communication; but it is likely to be developed and furnished with transportation lines sooner than financial considerations alone would warrant. The political and religious status of Quebec, with reference to the other Canadian prov-

inces, is such that the colonization and development of its territory is likely to be pushed with a zeal not due to regard for the almighty dollar alone.

One of the most important of the extensions in western Ontario is the Brantford, Waterloo & Lake Erie, now under construction, which is to be practically an extension of the Michigan Central system to Toronto.

The recent announcement by Sir John MacDonald that the Canadian Government is to be hereafter very chary of subsidies to new railway enterprises will probably put a decided check on the work of railway projectors, especially in Ontario, where they have been very active, and where the prospect of their receiving a bonus from the Provincial Government seems likewise poor.

The two most important enterprises in Maine are beyond the limits of our map. They are the Northern Maine railway, which is to furnish Aroostook county an outlet over American territory, and an extension of the Maine Shore Line east near the coast. Both of these lines have been located, and are likely to be built at an early day.

The principal interest in New England centers in the attempts to secure new competing lines between New York city and New Haven, Boston, and other points. The schemes for a parallel line to the New York, New Haven & Hartford between New York and New Haven is still being fought over in the Connecticut Legislature. A large amount has already been expended in surveying and securing rights of way for this line, and in fact on the whole of the New York & Boston Rapid Transit scheme. The projectors are likely to at least push their project to a point where they can get back the money they have already sunk, if that is possible.

Construction and surveys due to the new Hudson River bridge at Poughkeepsie are still in progress. On the east, the Hartford & Connecticut Western Railway is being extended to Springfield and to Poughkeepsie. The New York & Massachusetts Railway, which was to be the eastern outlet according to the original plan, is still independent; and its owners have done nothing but a little surveying toward the proposed extension from Boston Corners east to Westfield, Mass. West from the bridge the Hudson Connecting Railway is now nearly finished to Campbell Hall, and the old Pennsylvania, Slatington & New England, now likewise in the hands of the bridge syndicate, is being pushed rapidly to completion. The Poughkeepsie bridge railways will connect on the west with the New York, Lake Erie & Western, New York, Ontario & Western, New York, Susquehanna & Western, Central Railroad of New Jersey, Delaware, Lackawanna & Western, Lehigh Valley and Philadelphia & Reading systems. The prospect that the new route will secure a large coal traffic between Pennsylvania and New England cities is thus seen to be very fair.

The Poughkeepsie bridge seems likely to have a rival in a suspension bridge across the Hudson at Fort Clinton. The company which proposes to build the latter has made traffic contracts with several of the railways with which it will connect, and has begun work on the foundations for its structure.

It is somewhat difficult to account for the number of projected lines in the district south and east of Utica, N. Y. By no means all of these are likely to be built, however. The Schenectady & Ogdensburg Railway, shown on the map, has met with some opposition because of the effect its construction will be likely to have on the rapidly disappearing Adirondack forests. Its early construction, from all the information we can gather, is not very probable.

One of the most important lines on the map is the Buffalo & Geneva railway, which is projected to furnish an independent line to Buffalo for the Lehigh Valley system. Considerable work has already been done on the surveys

The most important lines in eastern Pennsylvania are the extension of the New York, Ontario & Western railway to Scranton, Pa., and the new independent line from Williamsport north to Binghamton, N. Y. The proposed South Mountain railway, practically an extension of the Poughkeepsie Bridge system to Harrisburg, and the Schuylkill & Lehigh road, just placed under construction and supposed to be in the Lehigh Valley interest, are also worthy of mention.

In New Jersey the principal work is of only local interest, with the exception of several projects which aim to secure better terminal facilities for the leading systems at a point opposite New York City.

The Baltimore & Drum Point Railroad in Maryland, running south from Baltimore 80 miles, is one of the longest systems now under construction in the East.

New bridges over important rivers are apt to cause considerable railway construction in their vicinity. The new bridge across the Ohio at Wheeling, W. Va., is drawing the Wheeling & Lake Erie and Cleveland & Canton systems to that point, and is one inspiring cause of the recently surveyed line east to Pittsburg. The activity of construction in the coal district between Coshocton and the Ohio river is especially noticeable. The several lines projected to reach Lake Erie from these coal fields do not seem to advance very rapidly. One of the most ambitious enterprises shown on the map is the Columbus, Lima & Milwaukee, which is to extend northwest from Columbus to a point on Lake Michigan. Its prospects of construction seem to be good.

It is interesting to notice that a new east and west trunk line across northern Ohio seems to be under way, if the four companies now working will agree to unite and work in harmony. The New York & Ohio, the Pittsburg, Akron & Western, the New York, Mahoning & Western and the Evansville, Fort Wayne & Chicago will, if completed and united, form a fairly direct east and west line, about 350 miles in length. The work thus far done has not been so rapid, however, as to call for much alarm among the present owners of trunk line stocks. The misfortunes of the Canada & St. Louis enterprise, whose proposed railway from Bay City, Mich., to Danville, Ill., is shown on our map, will be likely to make contractors and capitalists very wary how they undertake the construction of new independent railway lines of much magnitude so long as the public is disposed to fight shy of investments in their stock and bonds.

The northwestern portion of Michigan shows considerable activity, most of it in the timbered districts, where roads are constructed very cheaply to secure the lumber traffic from the forests adjacent to the line. Projects to tap the still untouched forests in the northeastern part of the State are also being agitated, and seem likely to go forward within a few months.

In Southern Indiana the extension of the Evansville & Terre Haute system has such a backing that it is very sure to be carried through. The two lines from Vincennes to the Ohio river have each of them a fair prospect of completion, according to the reports of their managers to us.

In Kentucky the tracklaying of last year is most noticeable. Three important lines, the Kentucky Union, the Kentucky Midland, and the Louisville Southern, are now being graded from the central part of the State eastward into the mountain regions, where moonshine whiskey and valuable mineral deposits are reported to be in remarkable abundance. All of these enterprises are said to be backed by abundant funds; and there is perhaps sufficient room in the *terre incognita* of eastern Kentucky for them all to reap profits. The Louisville, Cincinnati & Virginia, a project in the same region, is backed by well-known New York capitalists, and may yet be a successful rival to the lines which it will parallel.

The Charleston, Cincinnati & Chicago extension, running up to a connection with the Chattaroi Railroad, seems likely to be completed within a few months. Other independent lines surveyed and projected in the region southwest from Louisville, are being pushed into notice, and some of them have fair chances of success.

In West Virginia the most important line is the extension which the Norfolk & Western has located to Ironton, O. If the company is successful in floating bonds for the work, construction upon it will probably begin this season. The West Virginia Central Railway, besides the extension under construction, is projected to reach west to the Ohio river, and surveys are now in progress. All over the State there are numerous projected independent lines; and many of these, it is believed, will be built at an early date, as was stated last week.

In the portion of Virginia shown upon our map, the principal lines under way are the Farmville & Powhatan, Lynchburg & Durham, and Craig Mineral. The work in the southern part of Virginia and Kentucky will be shown on our map of the Southern States.

In general, the most important fact which the map and statistics show is that, at this time, when railway stocks have so fallen in value and investments in railway stocks seem so unpopular, the work of projecting, surveying, and building new railway lines shows, in the section of the United States best supplied with transportation facilities, an activity not exceeded even in the prosperous year of 1887.

The Memphis System of Sewerage.

Our readers will remember the controversies upon the Memphis system of sewers, reported in our columns from time to time a number of years ago. In the latter part of 1879 Col. Geo. E. Waring, Jr., came before the country with his proposition to give the fever-stricken and bankrupt city of Memphis a novel and "model" sewerage system.

He had achieved a wide reputation as a popular writer on sanitary as well as on literary subjects, and through his plausible arguments had gained the confidence of public and influential men in matters pertaining also to sanitary engineering. Early in 1880 he was entrusted with the design and execution of works for Memphis, which in their principal features he announced were "entirely new" and would constitute "a perfect system of sanitary sewerage." The proposed system was to embody the following features: "the exclusion of all rainwater," "the limitation of the size of the sewers to a diameter of 6 ins. until at the hour of greater flow this size was filled half full," "the placing of automatic flush tanks at the upper end of each branch sewer," "the entire absence of man-holes and the utter disregard of alignment, so far as the question of examination or cleaning is concerned," and "the ventilation of street sewers through the house pipes." It differed,

therefore, in some respects from what had previously been considered good practice.

Col. WARING was industrious in writing or inspiring popular articles upon this work, and we soon heard the "WARING system" recommended for a large number of cities in our country, including New York, Philadelphia, and Baltimore; and even abroad, Paris, Naples, and other cities were to avail themselves of this new and perfect system.

American and English engineers, however, looked upon the above innovations with more sobriety, and upon some of them with decided distrust. There had already been considerable experience gained with small pipe sewers on the "separate system," which substantially excluded rainwater. Early in the "fifties" such sewers had been built in England, and by 1878 a number of towns were at least partially supplied with them. Sir ROBERT RAWLINSON in his excellent "Suggestions" (published in 1876, and extensively sold in America through the agency of ENGINEERING NEWS) laid down his well known "rules" for pipe sewers, which were based upon a large experience and extended practice.

The first opportunity offered for a discussion of the new works by American engineers was a paper by Mr. F. G. ODELL, read before the American Society of Civil Engineers on Nov. 3, 1880. The advantages of the "separate" system were admitted, but some of the innovations, particularly the absence of man-holes, were severely criticised by E. S. PHILBRICK, J. J. R. CROES, and others.

A similar discussion and criticism followed a paper sent by Col. WARING himself, about the same time, to the Institution of Civil Engineers in London, in which he emphasized his proposition to do without man-holes and to disregard the straight alignment between them as being "the most striking departure from ordinary custom."

The Memphis works had then been in use but a short time, and it was too early to form a safe judgment upon the true value of all of the new departures, therefore no further discussion followed at that time. The views quite generally held, however, were that the sewers should be straight in line and grade between man-holes, that their size should not be less than 8 or 9 ins., and that the admission of some storm-water from roofs or paved backyards was rather beneficial than otherwise, and certainly a matter of great convenience.

Nearly four years later, our issue of Jan. 26, 1884, contained a letter from Mr. RUDOLPH HERING reporting the condition of the system as gleaned from a brief visit and examination. He states that, while they had apparently been carefully and intelligently managed, yet stoppages in the 6-in. pipes were frequent, necessitating the tearing up of the street each time; man-holes were therefore found to have become quite necessary, and in spite of the strictest regulation, rainwater was surreptitiously admitted from yards or roofs, which already had made it necessary to build several overflows and relief sewers.

Yet no official review of the actual working of this system has appeared until within a few weeks, when the superintendent in charge of the sewerage, Mr. R. F. HARTFORD, submitted a report upon the same to the City Engineer, Col. MERIWETHER, who transferred it to the superior municipal authorities.

As the Memphis sewerage has been so widely discussed on both continents, we quote from it quite freely in another part of this issue, and leave this report to answer Col. WARING'S promises, and to prove the correctness of views previously advanced in this journal.

Pile Driving Factors of Safety.

It will be remembered, by some of our readers at least, that in our issue of Dec. 29, 1888, we discussed somewhat at length "Formulæ for Safe Loads of Bearing Piles," and suggested the form

$$L = \frac{2\,w\,h}{s+1} \qquad (1)$$

as one than which "there was no better or safer formula for the *safe working load* for piles under all ordinary conditions; to be reduced under exceptional conditions (as notably with irregular penetration) but *never exceeded* unless pile was known to rest on rock and act as a column." In the formula, L = safe load in lbs., w = weight of hammer in lbs., h = fall of hammer in ft., and s = last penetration in inches.

This formula was deduced from the more general form of

$$L = F\,\frac{w\,h}{s+0.0833}$$

(in which F = a factor of safety and s = penetration *in feet*) by assigning to F a constant value of 6, a variety of examples showing that this sufficed to "cover adequately the weakest piles driven under fairly normal conditions, while not falling in any case sensibly below the loads warranted by good practice." None of the more complex formulæ, of which we presented nearly 20, gave materially different results, generally justifying somewhat higher loads.

Several correspondents have written us since, expressing approval of this formula, including one much-respected correspondent whose letter we published March 16, Mr. JOHN C. TRAUTWINE, Jr., but who yet expressed a preference for the more complex form which is endorsed by Mr. TRAUTWINE Sr.'s high authority:

$$L = F\,\frac{50\,w\,\sqrt[3]{h}}{s+1} \qquad (2)$$

the significance of the letters being the same as above given.

The pros and cons of the main question raised by Mr. TRAUTWINE'S letter we expressed our views on March 16, in a note appended to his letter, and do not propose to again consider; but there was one argument advanced in his letter which we shall briefly consider, as we then stated we should, since it has a certain general bearing on other questions of the kind; illustrating likewise, from our point of view, certain weaknesses of human nature, which crop out curiously in such matters, sometimes harmlessly, and sometimes not so harmlessly.

Mr. TRAUTWINE suggests that his formula (2) has a certain decided advantage from having in it the factor of safety, F, which can be "varied according to circumstances," whereas the result of the other formula is not so variable. He possibly carried with him the sympathy of many readers in his argument on this point, which we quote verbatim:

> Nor can I think the use of a constant factor of safety an improvement, for it aims to fix one of the most unfixable factors of the case, giving, as I understand, the same factor of safety for a low brick storage shed, in ground free from vibrations or inundations, as for a lofty cathedral, with a tidal river on one side, and the jar of railroad traffic on the other.
>
> While our ignorance remains, we must use its factor; and the denser that ignorance, the greater must be both the factor itself and its range of variation. It seems to me, therefore, more scientific (or, which is really the same thing, more practical) to try to approximate to the "extreme" load, and leave the factor of safety to the judgment. The result is shabby, but I don't see that the case admits of anything better.

This argument has a plausible sound, and in its statement of facts is perfectly correct. Formula (1) does give "the same factor of safety for a low brick storage shed, in ground free from vibrations or inundations, as for a lofty cathedral with a tidal river on one side and the jar of railroad traffic on the other." It gives, and was intended to give, values perfectly safe for the *worst* case, leaving the piles under the "low brick storage shed" to have a certain excess of strength, unless the engineer chose to presume on his favorable conditions to make a special case and advance beyond it.

Now, what possible advantage is there in doing otherwise? What but the shadow of an advantage, which is really an unmitigated disadvantage, is even promised by doing otherwise? Let us see what is the difference, and the only real difference, between these two formulæ.

Formula (2) says in effect: "Here is the load which any ordinary pile cannot resist. Some will carry only half, some a quarter, some a sixth or less (penetration, hammer and fall being always the same). Make your own guess—according to circumstances."

Formula (1) says in effect: "Here is the load that any ordinary pile (with given penetration, hammer and fall) is certain to resist. Some lucky ones may resist five or six times as much (of course, or it would not be a safe load), but any excess above this involves risk."

Now, is there any real difference between these two as regards applicability to varying conditions? There is one very real one, so far as we can see, and only one, viz.: *That Formula (2) enables a man to deceive himself with the notion that he is being cautious when he is really being rash*, while Formula (1) forces him to first expressly admit to himself that he is being rash. Hence Formula (2) appeals to some of the deepest foibles of our human nature, for we all like to persuade ourselves that we are wiser and more cautious than we are. But the essential nature of the act is precisely the same when the engineer takes a certain maximum load which is never safe, and, on the strength of his own judgment only, says, "I will use a third of that load in this case, but only a sixth of it in that," as when he takes a formula which simply gives the universally safe load and says, "I will use this value in this case, where I want to be sure; but in that other case, which seems less important and to have better conditions, I will double the load,"—hammer, fall and penetration being understood to be always the same.

Nay, if a man is going to vary in this way, according to circumstances, we maintain that he can do it more correctly and surely by increasing from a lower "always safe" value, than by decreasing from a higher "always unsafe" value; but is it really justifiable to do it at all, in pile-driving at least, and is there really the slightest justification or excuse to embody in a formula an invitation to do so? It is to be remembered that the piling is always planned before the precise nature of the soil is known, and that even after the piles are all driven we do not know it fully. No one in his senses reduces the number of piles that he had previously planned because he finds the indications as to soil a little better than he counted on. He may increase the number of piles under reverse conditions, but that is only because he either cannot get uniform penetration, or cannot get last penetrations as small as he expected. There remains therefore only the question of whether it is wise and proper to countenance in a formula loading piles under a "low brick storage shed" with twice the loads that piles *driven by equal hammer blows to equal penetrations* bear under a "lofty cathedral."

No one will dispute that, under some rough-and-ready temporary structure, it may be proper to pile on hap-hazard all the load the piles will carry, and let them settle or not as it

happens; but if a "low storage shed" be built *to stay*, we see no reason why its 40 or 50 piles should be more heavily loaded than the two or three thousand piles under the cathedral. Its ground "free from vibration" may next year have tracks on both sides of it. Its load is variable and may be highly vibratory, while the cathedral load is not. Its soil just below the piles may be far worse than suspected. A failure of a single pile cracks and perhaps destroys it. Does it pay to take these chances simply because the building is unimportant, if it is intended to be permanent?

When, as in bridge designing, the necessity for a varying factor arises from known and in a sense measurable differences of conditions, as in floor-hangers and main members, then there is some reason and excuse for varying factors; but when the causes for actual variation are wholly unknown and unforeseeable, as among a hundred piles driven to exactly the same penetrations by similar and equal blows, we see no reason for taking further chances with any kind of permanent structure, to save so cheap an article as piles. For every structure the load should be that load under which no one of a hundred or a thousand such piles will fail, and not a half or quarter or sixth of that under which they may be expected to all fail. "Factors of ignorance" must remain numerous enough at best; there is no excuse for encouraging or perpetuating them unnecessarily, and thus tempting the reckless to folly, or the ordinarily cautious to needless error.

A Remarkable Run with the "Strong" Locomotive.

A locomotive of the "Strong" type, the invention of Mr. GEO. S. STRONG, which has been running recently with regular passenger trains on the New York, Lake Erie & Western Railroad, made two remarkable runs this week between Jersey City and Buffalo, a distance of 423 miles, which distance is usually divided between four engines. The longest continuous run on record made by one engine was on the Pennsylvania Railroad between Jersey City and Pittsburg, 444 miles, in 1875, with the famous transcontinental theatre train; and considering that the average run of an ordinary locomotive is about 100 to 125 miles, and that the Strong engine made two runs of 423 miles each in two consecutive days, the record of this engine is very remarkable, especially as it did the work with a regular train, and without meeting with the slightest mishap of any kind. On Monday, April 1, the engine was attached to the 9 A. M. day express from Jersey City, and in spite of several delays, arrived at Buffalo at 10.27 P. M., three minutes ahead of time. On Tuesday, April 2, it was attached to the 9.15 A.M. eastbound express, and arrived in Jersey City at 11.56 P. M., one minute behind time. As the engine was hauling a regular train, it had to keep schedule time, and the trial was therefore not one for speeding, but for endurance; delays and detentions, however, gave a chance for fast running to make up time, so that, taken altogether, the round trip was a good practical test of the power, endurance, and speed of the engine, and the results were excellent. The Strong Locomotive Co. (office at 45 Broadway, New York City) provided a special car and all entertainment for a number of newspaper and railway men, and others interested, and the excursion was made a very pleasant and interesting occasion. Mr. TAINTOR, the Treasurer, was the presiding host.

The engine, of which we shall probably give further details in a later issue, was built in 1888, by the Hinkley Locomotive Co., of Boston, Mass., and has been given experimental runs on several Eastern roads, showing great power and high speed. There are two furnaces, each in a corrugated steel flue, and these flues unite in a combustion chamber, at the opposite end of which is the tube plate. This arrangement enables long runs to be made, as one fire can be cleaned while the other is bright and making steam; it also effects more complete combustion, thus making a considerable saving in fuel consumption, and for long distances the clouds of steam from the stack are clean and white, smoke showing only at long intervals, when a fire is being cleaned, when steam is shut off, or when fresh coal is thrown on a dull fire. It is claimed that no spark arrester is needed and the engine has a straight stack and no extension front or other spark arresting arrangement, but when hauling a heavy train up a steep grade, it threw sparks considerably. The cylinder valves are of the gridiron type, placed vertically, and there is a steam and an exhaust-valve at each end of both cylinders. The valves of each cylinder are operated by a single eccentric, the valve gear being an improvement on that originally designed, which was worked from the connecting rod. The rigid wheel-base is short, but the total wheel-base is very long, and the engine rides very steadily. The engine, which is named the "A. G. Darwin," No 1, after the president of the company (which name gave rise to a number of reportorial jokes about the evolution of the locomotive) differs from the "Duplex," No. 444, on the Lehigh Valley Railroad, in having four instead of six driving-wheels. The latter engine, No. 444, has made some very good records, and accounts and details of running tests, with a description of the engine, were published in ENGINEERING NEWS, Sept. 17 and 24, 1887. This engine is especially designed for climbing steep grades.

The "A. G. Darwin" has cylinders 19 ins. x 24 ins., four driving wheels 68 ins. diameter, a four-wheeled leading truck and a two-wheeled trailing truck under the firebox. The cross-heads are of the form patented by Mr. F. W. DEAN; they are T-shaped, sliding on the under side of the horizontal portion, the connecting rod being attached to the leg. The coupling rods are of I-section. The total weight is 136,000 lbs., with 76,000 lbs. on the drivers. The tender has a four-wheeled truck at the forward end, and a six-wheeled truck at the rear; it carries about 7 or 8 tons of coal and 28 tons of water. The fireman's station is on the footplate of the tender, which is roofed over, and the engineer's cab is just behind the dome. We would suggest that some special arrangement for signaling or communicating between the two cabs should be fitted up, as the engineer can only signal the fireman by ringing the engine bell, which is very likely not to attract his attention, and the latter can only signal the engineer by pulling the train bell-cord. The fireman is kept busy attending to the two fires, and is quite isolated from the engineer, especially at night, as we noticed while riding on the tender. A gangway runs along the top of the boiler between the cabs, but is necessarily not easily accessible. The coal used was soft and dirty. The furnaces are fitted with shaking grates, having interlocking fingers. The economy in fuel consumption is one of the principal advantages of this class of engine, the saving being estimated by Mr. F. W. DEAN, who has conducted careful tests of the performance, at between 30 and 40 per cent. of the ordinary consumption.

The table given shows the stops, distances, and the actual and schedule time, by comparing which it will be noticed that the engine always made up lost time; the delays were caused by bridges, coaling, signals, etc., and in one case, near Callicoon, on Monday, by a broken down freight train, the engine of which had blown out a cylinder head. High speeds were attained very quickly after starting with a heavy train, and the engine took the train over the series of curves on the Delaware division (following the course of the river) at considerable speed, riding very easily. A speed of a mile a minute was frequently made, and this speed was maintained for 5 or 8 minutes, or more, at different times. On Monday one mile was made in 55 seconds. The west-bound train started with 6 cars from Jersey City, (1 baggage, 2 Pullmans, and 3 ordinary passenger cars), a mail car was added at Port Jervis, two more cars were added at Elmira, and were taken off at Hornellsville. The east-bound train started from Buffalo with 8 cars, 3 more were added at Hornellsville, 2 were taken off at Elmira, leaving 9 cars, 4 of which were Pullmans; another car was taken off later. The standard Erie passenger cars weigh about 48,000 lbs. and the Pullmans from 70,000 to 86,000 lbs. Going east, coal was taken at Jersey City, Port Jervis, Lackawaxen, Elmira, and Hornellsville. It was interesting to note the steadiness with which the steam pressure was maintained, averaging about 150 lbs per sq. in., the safety valves being arranged to blow off at about 152 lbs.; within a minute or two of stopping the train, the steam would be blowing off. Mr. STRONG was with the train and had his own engineer and fireman; the regular engineer and fireman for each of the four divisions were also on board over their own divisions to act as pilots, and there was an extra hand on the tender, keeping the coal well down on the footplate handy to the fireman. One of the regular engineers, who has been running for 40 years, 33 of which have been on this road, expressed a wish that the railway company would put on some of these engines and give him charge of one.

The "Strong" engine is especially interesting in having in its fire boxes, valves and valve gear radical departures from the ordinary type of locomotive, which type is now practically the same as when it was first designed by Stephenson. This class of engine has certainly shown its efficiency in actual service, and it will probably come into extensive use, although its introduction must necessarily be slow at first. The Lehigh Valley Railroad has now one engine in regular service, the "A. G. Darwin," is intended for the Atchison, Topeka & Santa Fé

Table of Running Time.

Eastbound, April 2.				Stations.	Miles	Westbound, April 1			
Schedule Time		Actual Time.				Actual Time		Schedule Time.	
Arrive	Leave	Arrive	Leave			Arrive	Leave	Arrive	Leave
		P. M.					A. M.		A. M.
	11.55	11.56	.....	Jersey City	.....		9.24	.....	9.20
	10.26	10.23	10.26	Paterson	17		9.52	.....	9.52
	—	—	—	Tuxedo	39	10.31	10.32	.....	10.30
	9.35	9.38	9.43	Turner's	47	.....	10.52	.....	10.49
	—	—	—	Greycourt	54	.....	11.06	.....	11.01
	9.06	9.12	9.13	Goshen	60	.....	11.16	.....	11.12
	8.55	9.00	9.04	Middletown	67	.....	11.30	.....	11.26
7.55	8.15	7.55	8.20	Port Jervis	88	12.03	12.20	12.05	12.25
	7.17	7.10	7.17	Lackawaxen	111	1.01	1.00	.....	1.05
	—	—	—	Narrrowsburg	122	1.26	1.28	.....	1.24
	6.30	6.27	6.33	Callicoon	136	2.05	2.09	.....	1.49
	5.43	5.50	5.51	Hancock	164	2.43	2.46	.....	2.35
	5.20	5.28	5.32	Deposit	177	3.06	3.07	.....	2.58
4.40	4.45	.....	*4.45	Susquehanna	192	3.33	3.41	3.31	3.34
	4.22	4.22	4.23	Great Bend	201	3.53	3.54	.....	3.58
3.50	3.58	3.49	3.58	Binghamton	215	4.11	4.18	4.11	4.15
	3.35	3.31	3.33	Union	224	4.30	4.31	.....	4.28
3.00	3.12	3.06	3.12	Owego	237	4.48	4.49	4.45	4.47
	2.36	2.40	2.42	Waverly	256	5.12	5.15	.....	5.15
2.06	2.09	2.10	2.17	Elmira	274	5.41	5.59	5.41	5.51
	1.39	1.43	1.46	Corning	291	6.24	6.26	.....	6.18
	1.21	1.18	1.26	Addison	302	6.43	6.45	.....	6.38
	12.39	12.42	12.43	Canisteo	328	—	—	.....	—
12.10	12.30	12.09	12.31	Hornellsville	332	7.20	8.05	7.27	7.45
	—	—	—	Canaseraga	344	8.23	8.24	.....	8.07
	11.22	11.22	11.22½	Portage	362	8.27	8.27¼	.....	8.36
	11.12	11.12	11.13	Castile	366	8.56	8.57	.....	8.46
	11.05	11.06	11.06½	Silver Springs	368	—	—	.....	—
	10.52	10.48	10.53	Warsaw	376	9.12	9.18	.....	9.05
	10.20	10.17	10.21	Attica	393	9.40	9.44¼	.....	9.35
	9.26		9.31	East Buffalo	421	—	—		—
	9.15		9.15	Buffalo	423	10.27	.....	.....	10.30
	A. M.		A. M.			P. M.			

* 4.53 from the coal tip a short distance east of the station.

Railroad, and two more engines are now being built by the Schenectady Locomotive Works, of Schenectady, N. Y.

Tests of Direct Process (Carbon Iron Co.) Steel.

The following record of the tests of 19 different samples of this new product, which was fully described in our issues of Jan. 21 and March 24, 1888, will show what excellent bridge material is now turned out by it. The heavy reduction of area, rising in one test to 75.12 per cent., and in only one case falling below 60 per cent., and in 8 cases below 65 per cent., is especially notable. The elastic limit also runs noticeably high and uniform for a product capable of such great reduction of area. The tests were made by two different inspectors Messrs. FERRIS and HUNT & CLAPP, of Pittsburg, and may, we believe, be implicitly relied on.

Heat Number.	Elastic Limit lbs. per sq. in.	Ult. strength lbs. per sq. in.	Elongation per cent.	Per cent. reduction.	Test Cut From.	Remarks.
378	34,630	64,700	34.50	67.19	24 × ⅞	45° S.
373	43,320	65,980	28.00	66.75	36 × ⅞	"
370	38,010	67,000	34.75	60.63	7⅛ × ⅞	C. S.
379	37,900	63,870	32.00	61.35	10 × 1	C. Irreg.
364	38,770	64,420	29.50	63.24	18 × ⅞	½ C. S.
370	39,280	58,400	28.25	63.33	6½ × ⅞	45° S.
301	38,830	63,870	32.00	65.83	18 × ⅞	"
305	37,110	58,230	29.50	61.05	13 × ⅞	½ C. S.
353	40,390	64,230	31.25	66.53	24 × ⅞	C. S.
371	41,350	64,740	32.75	61.99	14 × ⅞	45° S.
361	47,150	66,010	31.25	59.22	18 × ⅞	"
341	38,140	66,620	29.00	64.50	14 × ⅞	C. S.
352	36,970	60,270	33.75	73.17	24 × ⅞	Irreg. S.
368	41,870	57,300	29.00	66.90	9 × ⅞	"
380	36,910	59,080	36.50	71.25	20 × ⅞	C. S.
358	37,270	57,810	36.00	71.13	29 × ⅞	"
372	40,200	57,670	34.75	69.62	20 × ⅞	S. Irreg.
382	38,170	56,780	31.25	68.50	20½ × ⅞	C. S.
355	38,440	58,300	29.37	75.12	25 × ⅞	"

Wood Preservation.

Le Bulletin de la Société d'Agriculture gives an account of a series of experiments made in Germany on the preservation of wood by means of sulphate of copper and tar.

In the spring of 1874 a palisade was constructed of piles from 3½ to 7 ins. square; the wood was fine, recently cut and still green. It was immersed for two hours in a boiling 4 per cent. solution of sulphate of copper, then plunged into lime-water in order to neutralize the excess of acid, and dried. The piles were driven 25 ins. into the earth. To establish comparisons, there were inserted at intervals some simply carbonized at the ends, and others which had been plunged in tar. Ten years later the piles prepared with the sulphate of copper were found intact and without other traces of alteration, save cracks caused by the drying. The piles, with the extremities carbonized or tarred, were found, on the contrary, quite decayed. It must be noted that green wood was in question. The same experimenter, having compared sulphate of copper and tar on seasoned wood, found that the tar was the most suitable under these conditions. For unseasoned wood in general, the sulphate of copper is to be recommended, with the sole condition that the maceration in the boiling bath be prolonged in order that it may penetrate perfectly the interior of the wood.

Experiments have been made on the preservation of wood placed in the ground. Pieces of oak sunk in the ground, in the direction of the growth of the tree, decayed in 12 years, while identical pieces, coming from the same trees, but inserted in the opposite way, showed hardly any trace of decay in the same time. The phenomenon is explained by the moisture which follows the capillary tubes of the wood. The simple precaution of placing the wood in the ground opposite to the way in which it grew would seem to augment considerably its durability.

CORRESPONDENCE.

A New Transit Book.

TAZEWELL, Va., March 30, 1889.

TO THE EDITOR OF ENGINEERING NEWS:

I desire to call the attention of the profession to a new form of transit book lately issued by Messrs. Williams & Brown, of Philadelphia, which is ruled in accordance with the method of keeping transit notes so ably advocated by you in your valuable journal during the past year.

The firm ought to be congratulated on their courage in breaking away from beaten paths and giving the profession a book based on a rational method and in strong contradistinction to a vagary of the bygone past. There should be a large demand for the book. Yours truly,

EMILE LOW.

Allowable Strains in Old Bridges.

LOGAN, O., March 19, 1889.

TO THE EDITOR OF ENGINEERING NEWS:

In the course of inspection and the investigation of existing structures, many problems are presented to the engineer which are never met with in the design of new work and which require special treatment.

One which will be of much interest at the present time, owing to recent discussions of bridge failures and the existence of many very weak bridges, is the maximum strain per square inch which should be allowed before a structure is positively condemned. It has been the custom with many engineers of my acquaintance to call a halt when 20,000 lbs. per sq. in. is reached, assuming safety below this. Noting the impropriety of assuming one value for all conditions, and how excessive this would be in the case of a hanger or piece having a great excess of live load, I sought for some more rational method.

In structures designed to carry loads, two extremes can be imagined: *First*, where the load is a pure dead weight. *Second*, where the load is a pure live weight.

The first condition is very nearly realized in the case of a roof truss, where the load is very nearly pure dead weight; supposing the iron to have an elastic limit of 26,000 lbs. per sq. in., there would be no deformation caused in allowing the actual existing unit strain to reach 26,000 lbs.

Taking the second case, where the load is all a live one—a condition never reached practically—RANKINE found that (Civ. Eng. Art. 149) "a bar, to resist with safety the sudden application of a given pull, requires to have twice the strength that is necessary to resist the gradual application and steady action of the same pull." In other words, a piece will stand but one-half as much pure live load as pure dead load. A discussion of this may be found in any work on strength of materials.

Then, supposing theoretical conditions, and denoting by *min. B* the minimum and by *max. B* the maximum load, by the first case $\frac{min.\ B}{max.\ B} = 1$ and in the second $\frac{min.\ B}{max.\ B} = 0$

Letting e = elastic limit and s = maximum allowable unit strain, then by taking $\frac{e}{2}$ and the above values of $\frac{min.\ B}{max.\ B}$, the foregoing facts may be expressed in a formula as follows:

In the first case, where $\frac{min.\ B}{max.\ B} = 1$, $\frac{e}{2}$ will require to be multiplied by 2, to produce the value found to be the maximum allowable or by $1 + \frac{min.\ B}{max.\ B}$; in the second case, where $\frac{min.\ B}{max.\ B} = 0$ and $\frac{e}{2}$ is the maximum allowable, we must multiply by 1 or by $1 = \frac{min.\ B}{max.\ B}$.

In both extreme cases assumed, $s = \frac{e}{2}\left(1 + \frac{min.\ B}{max.\ B}\right)$, a form similar to LAUNHART'S in its practical shape, but reached by an entirely different method; in this form, it is found to give rational values for cases intermediate between those assumed.

Taking a case actually existing, where three rods in a Howe truss, 1⅞ in. round upset, carry *D. L.* = 14.85 tons, *L. L.* = 33.90 tons and impact = 2.73 tons

$$\frac{min.\ B}{max.\ B} = \frac{14.85}{48.75} = .305$$

Then assuming e = 26,000 lbs. per sq. in., s = 13,000 (1 + .305 = 16,965 lbs. per sq. in., while that actually existing is found to be 12,434 lbs. per sq. in. or a factor for safety of about 1.4, against 1.6 in., *assuming* 20,000 lbs. per sq. in. as maximum allowable.

In another place, three 1 ⅛ in. round upset rods sustain *D. L.* = 2.38 tons, *L. L.* = 16.36 tons and impact = 2.73 tons.

$\frac{min.\ B}{max.\ B} = .127$; s = 13,000 (1 + .127) = 14,651 lbs. per sq. in. the actually existing unit strain = 14,460 lbs. per. sq. in. practically reaching the limit, while by the old way of 20,000 lbs. sq. in., there is still a factor of 1.38.

Taking one more case of a hanger in a Pratt truss or stirrup hanger 1 ⅛ ins. round, upset *D. L.* = 4,217 lbs., *L. L.* = 27,607 lbs., and impact = 6,902 lbs.

$\frac{min.\ B}{max.\ B} = .1325$; s = 13,000 (1 + .1325) = 14,722 lbs. sq. in. the actual existing strain being 17,443 lbs. per sq. in., or past the danger line, while by the old method it would have a factor for safety of about 1.14.

It is seen that while no pretensions are made for absolutely correct values, the method is *much more rational* than the assuming of one value for all cases, which will be found in many cases much too high. In no case in practice could the minimum value be reached, for there is always some dead weight, if only of the bar itself, which resists the stress. The method can be applied to other kinds of stress and other materials in ways similar to the application of LAUNHART'S.

In the investigation of existing structures, using the dead load and the live load without impact, from the formula the maximum allowable unit strain may be obtained. For the unit strain actually existing, use the dead load, live load, and impact. Then the ratio of the two—the unit strain allowable and the unit strain existing—will determine the degree of danger.

A table, for any value of "e," of the values of "s" for varying values of $\frac{min.\ B}{max.\ B}$ may be prepared, making the application of the method very easy; such a table for e = 26,000 lbs. is here given.

Maximum strain allowable, e = 26,000 lbs.

Min. B / Max. B	Unit Strain, s	Min. B / Max. B	Unit strain.
.000	13000	.525	19825
.025	13325	.550	20150
.050	13650	.575	20475
.075	13975	.600	20800
.100	14300	.625	21125
.125	14625	.650	21450
.150	14950	.675	21775
.175	15275	.700	22100
.200	15600	.725	22425
.225	15925	.750	22750
.250	16250	.775	23075
.275	16575	.800	23400
.300	16900	.825	23725
.325	17225	.850	24050
.350	17550	.875	24375
.375	17875	.900	24700
.400	18200	.925	25025
.425	18525	.950	25350
.450	18850	.975	25675
.475	19175	1.000	26000
.500	19500		

Believing the method to be more satisfactory than the old, in that it is more rational, and hoping it may be of service to the Engineer of Maintenance of Way in particular,

I remain, very truly yours,

C. E. FOWLER,

Bridge Engr., Motherwell I. & S. Co.

[We were not aware that the assumption mentioned as to 20,000 lbs. per sq. in. was in vogue anywhere, and consider that it leads to very unsafe conclusions.—ED. ENG. NEWS.]

The Ventilation of Sewers through Chimneys.

NEW YORK, March 31, 1889.

TO THE EDITOR OF ENGINEERING NEWS:

In looking over ENGINEERING NEWS this evening, I notice in the correspondence column a letter from O. H. W., in Boston, on the ventilation of sewers, suggesting the connection of sewers with the chimneys of large establishments. This method, as you say, has been much discussed, and to some extent used.

Perhaps the most important effort made to carry out the suggestion was at the Deptford pumping station of the London main drainage over 20 years ago under unusually favorable conditions. That it did not prove successful may be evident from a little reasoning. The suction in the chimney tends to produce a vacuum in the sewer. If greater than the weight of a column of water, equal to the depth of the nearest trap, the water is sucked out, and the air rushes in at a rate to satisfy the intensity of the draft. As all sewer connections from houses are guarded by a seal of only one or two inches in depth, it is not practicable to give the air in the sewers any tension, and therefore all methods of artificial ventilation have proved worse than useless by destroying the seals of the traps nearest the chimney. The sewer air must remain substantially under atmospheric pressure. This is necessary from a number of natural causes, irrespective of the above artificial one.

The seals of traps tend to break by unequal temperatures of the air on each side, by the wind blowing into the mouth of the sewer, by the suction in a sewer running nearly full, and particularly by the varying quantities of sewage. To most of these cases calculation can be applied. Take the last one, and suppose a pipe sewer having no communication with the atmosphere, running one-third full. Then suppose a flush to make it run two-thirds full, compressing the air contained in it (if none of it could escape) to one-half its bulk. The consequence would be a pressure equal to one atmosphere, forcing a trap with a seal of anything less than 32 ft. This suppositious case indicates the importance of letting the sewer air alone, and by giving it free access to the atmosphere, letting it circulate through the above mentioned natural causes, as freely as possible.

Mr. O. H. W. seems to think that sewer air always rises. This is not so. It has practically the same special gravity as the air above ground. A careful series of experiments made by Dr. RENK in the sewers of Munich for the Hygienic Institute of that city showed that the current of sewer air was downward quite often, both in the entrapped house pipes and in the sewers, and particularly so in summer, when the sewer air was cooler than the atmosphere.

The way to prevent bad smelling gases from rising from open man-holes, is first to build your sewers properly, so that the laws of flowing water and air are complied with, in particular to prevent deposits and stagnation; secondly, to flush and clean them often of the slimy and other growths which are bound to accumulate; and thirdly, to prevent illuminating gas from leaking in, to the sewers through the soil from badly jointed pipes.

In some instances it may be best to carry special ventilating pipes from the sewers to above the roofs of houses, or, as in some cities, to use the soil pipes for this purpose. The latter is done quite generally in the larger cities of Germany, and apparently meets with approval; but open man-holes are still retained.

RUDOLPH HERING.

PERSONAL.

Hon. JOHN HENRY POPE, Canadian Minister of Railways, died in Ottawa on April 1, after a long illness.

Hon JOHN OVERTON, Jr., of Memphis, has been elected President of the Tennessee Midland.

Mr. JAMES KELLY, of Manchester, Md., for many years county surveyor of Carroll county, died March 24.

Mr. E. M. ALVORD has been appointed Purchasing Agent of the International & Great Northern.

Mr. B. W. CLOUD has been appointed Superintendent of Water-Works at Woodbury, N. J.

Mr. C. C. ROBINSON, General Foreman of the Peoria, Decatur & Evansville Ry., is now Master Mechanic of that road.

Mr. HENRY PEIRCE has been appointed Engineer of Maintenance of Way of the Chesapeake & Ohio road. His headquarters are to be at Cincinnati.

Mr. J. D. LIVINGSTONE has been appointed General Manager of the Chicago & Ohio River Railway, with headquarters at Kansas, Ill.

Mr. J. ALFRED BARNARD has been appointed Purchasing Agent of the Ohio & Mississippi, with office at Cincinnati, O., vice Mr. G. W. STEVENS, resigned.

MR. B. D. MCCONNELL, acting superintendent of the Montreal water department, will probably be confirmed as superintendent to succeed Mr. LOUIS LESAGE.

Mr. B. P. LORD, of Altoona, Pa., has been appointed Assistant Superintendent of Motive Power of the Pennsylvania Railroad, with headquarters at Fort Wayne, Ind.

Mr. ROBERT SMITH, Treasurer of the Pennsylvania Railroad, will assume the duties of Secretary and Treasurer of the Philadelphia, Wilmington & Baltimore road, in addition to his other duties.

Mr. L. D. BUTTON, Chief Clerk in the Kanawha & Ohio office, and Private Secretary to President KELCY during his management of the company, has been appointed General Superintendent of the road, with headquarters at Charleston, W. Va.

Gen. JAMES H. WILSON has been appointed Interstate Railroad Commissioner by President HARRISON to fill the vacancy caused by the resignation of Commissioner WALKER. Gen. WILSON was formerly connected with the New York & New England Railroad.

THE New York Cement Co., formerly of No. 5 Dey St., of which Mr. THOS. MILLER is President and Mr. THOS. MILLER, Jr., is Secretary, have removed to their new offices in the Telephone Building, No. 18 Cortlandt St., New York.

Judge ELISHA C. FIELD, of Crown Point, Ind., for 10 years Circuit Judge of the judicial districts composed of Lake and Porter counties, has resigned, to become General Solicitor of the Louisville, New Albany & Chicago Railway Co., with an office in Chicago.

Mr. WEATHERSBY (or WETHERS), one of a corps of engineers engaged in surveying a new line from Montgomery to Anniston, for the Anniston & Montgomery Ry., was drowned March 19 in the Tallapoosa river, while his party was engaged in making soundings for foundations for a bridge.

Hon. JOHN SCOTT, President and one of the Receivers of the Allegheny Valley Railroad Co., died March 24 at Pittsburg, Pa. He was formerly President of the Pittsburg, Virginia & Charleston Railroad Co., and a Director of the Pennsylvania Railroad Co., and was one of the originators of the Edgar Thomson Steel Co.

Mr. JOHN CRAIG has been appointed auditor of the Seattle, Lake Shore & Eastern Railroad, vice Mr. F. A. ALLEN, who has taken the position of General Passenger and Freight Agent. Mr. J. T. SHEPHARD has been appointed Assistant Treasurer.

Mr. T. A. ALLEN, Chief Engineer of the Peoria, Decatur & Evansville Division of the Evansville & Terre Haute Railway system, has had his duties extended to the Evansville & Terre Haute, Evansville & Indianapolis and Evansville Belt roads, with headquarters at Evansville, Ind.

Mr. HARVEY FREEMAN GASKILL, Vice-President of the Holly Manufacturing Co., died in Lockport, N. Y., on April 1, aged 44 years. Mr. GASKILL was born in Royalton, N. Y., Jan. 19, 1846; after some previous business experience he entered the Holly shops early in life, and by his general ability and inventive talent soon attracted the attention of Hon. T. T. FLAGLER, President of the company. His chief invention was the now famous Gaskill pumping engine, whose manufacture is to-day the leading industry of the Holly Company. Mr. GASKILL leaves a host of friends, and would doubtless in time have succeeded to the office in the company now held by its energetic but venerable President.

City Engineer NEALLY, of Topeka, Kansas, has come out ahead in his long-standing controversy with Mayor METSKER of that city, who attempted to illegally oust him from his office last summer. The Supreme Court of Appeals now decides that the plaintiff was by undisputed right City Engineer, and that the Mayor alone had neither power to suspend or remove him, as the law gives this power to the Mayor and city council jointly The action of Mayor METSKER was therefore illegal, and Mr. NEALLY still remains City Engineer.

Mr. EDWARD P. ALLIS, late head of the Reliance Iron Works of Milwaukee, Wis., died on April 1, aged about 65 years. Mr. ALLIS was born in Cazenovia, N. Y., in 1824, was graduated from Union College, and went West at an early period. In 1860 he, with two associates who backed out before a year, purchased a bankrupt iron works in Milwaukee. Commencing with a business of $32,000 per year, 30 men and an annual pay-roll of $13,000, he extended it by his energetic efforts until now the establishment employs 1,000 men, pays them $500,000 per year and does an annual business of $3,000,000. In his works the great triple-compound pumping engines were lately made for Milwaukee.

Mr. JAMES T. FURBER, General Manager of the Boston & Maine, has issued the following notice of changes:—"The office of Master of Maintenance of Way of the Western Division is hereby abolished, and the maintenance of road, bridges and buildings, on the Western Division, will hereafter be under the charge of the Chief Engineer. The Western Division road department will be under three roadmasters, who will report direct to the Chief Engineer. Mr. A. E. SMITH will, as roadmaster, have charge of the road between Portland and Exeter, and the Great Falls, Kennebunkport and Orchard Beach branches. Mr. E. W. LYDSTON will have charge of the road as Roadmaster between Boston and Exeter, and the West Amesbury, Newburyport, South Reading, Georgetown, Medford, Lowell and Andover branches. Mr. E. MORRILL will be Roadmaster of the Manchester & Lawrence Railroad.

PUBLICATIONS RECEIVED.

—*Census of Massachusetts*, 1885. Part II; Population and Social Statistics. Prepared under direction of CARROLL D. WRIGHT, Chief of the Bureau of Labor Statistics. pp. 133.

This is a really notable census compilation, containing much fuller and more carefully digested information than any which has heretofore appeared in this country, or we might perhaps safely say, any other. We shall notice its contents more fully later.

A Brief History of Patent Legislation in the United States, by D. WALTER BROWN, Ph. D., 128 Broadway, New York. 1889. Pamphlet, pp. 17.

This pamphlet contains information useful to inventors and intending investors in patents; being a carefully prepared digest of all the Patent Acts from 1790 down to the Revised Statutes of 1874, and later laws. It makes a handy book of reference.

Proceedings of a General Conference of Railroad Commissioners, held at the office of the Interstate Commerce Commission, at Washington, D. C., March 5-7, 1889. Published by the Interstate Commission. 6 × 9 ins. 152 pp. cloth bound.

The contents of this volume were fully abstracted in ENGINEERING NEWS, March 9, 16, 23, of the current volume. The appendix contains a table showing the data pertaining to railways called for by the Interstate Commission and the various State Commissions.

—*South Brunswick Terminal R. R. Co.*, South Brunswick & Cordele R. R. Co. and Brunswick Harbor and Land Co.

This is a very handsome prospectus, issued under the direction of Mr. LEO VON ROSENBURG, and intended to set forth the advantages of this Georgia enterprise. It is illustrated by maps, phototypes, etc.

—*Transactions of the Arkansas Society of Engineers, Architects, and Surveyors.* Vol. II. November, 1888. Price 50 cts.

This volume contains the constitution, by-laws, and list of members, and the proceedings of the second annual convention of this Society as held at Little Rock, November 22, 23, 24. It also includes a number of interesting papers read at that convention as follows:—"Proportionate Error in Surveying," CHAS. W. STEWART; "The Climate of Arkansas," W. U. SIMONS; "Public Highways," JAMES A. MARTIN; "Arkansas Timber for Railway Purposes," E. C. BUCHANAN; "Descriptions for Deeds," WM. MITCHELL; "The Plane Table," D. C. B. AIKEN; "Topographic Maps by Reconnoissance Methods," ARTHUR WINSLOW; "Municipal Improvements of Little Rock," G. P. C. RUMBOUGH; "Water Supply of Rogers," JAY M. WHITHAM.

Copies of this issue can be had by addressing Mr. FRED. J. H. RICKON, Corresponding Secretary, Little Rock, Arkansas.

SOCIETY PROCEEDINGS.

American Society of Civil Engineers—The regular meeting was held April 3, Vice-President FTELEY in the chair. The Secretary announced the deaths of E. P. ALLIS, Fellow, and JOHN ERICSSON, Honorary Member.

The announcement was made that the annual convention will be held at Seabright, N. J., at the end of May, immediately before the departure of the party going to Europe; this party will sail on the *City of New York*, May 29.

A paper by Mr. EMIL KUICHLING, on "Experiments on Flow in Combined Sewers," was read by the Secretary. The paper opened with reference to statistics of flow in the sewers of London (England). It is very desirable that sewers should be of sufficient capacity to carry off the greatest flow of storm water, as floods in any district of a city, if only occurring at long intervals, not only cause damage and annoyance, but are dangerous to health, and cause a depreciation in the value of property. In designing sewers, therefore, it is the absolute maximum amount of water entering the sewer that must be taken into account, and most of the present formulæ in use are insufficient. In the discussion, Mr. HERING stated that little is known on this important subject, and it is difficult to get city authorities to provide the necessary funds and facilities for gaugings, etc., as they generally consider it rather a scientific plaything than a matter of practical utility. Generally, the amount of water getting into the sewers is underestimated. If sewers are made too large, they involve an unnecessary expenditure, but if too small, there is trouble from flooding. The appropriation of $2,000 for automatic rain gauges asked from Congress last year was refused, but Gen. GREELY, of the U. S Signal Service, has had some of these gauges put in.

The following candidates were declared elected:

MEMBERS.

WILLARD BEAHAN, Chili, South America.
EDWARD J. BLAKE, Chf. Eng., Hannibal & St. Joseph R. R., St. Joseph, Mo.
HORACE J. CAMPBELL, Chicago, Ill.
WILLIAM W. COE, Chf. Eng. Maintenance & Construction, Norfolk & Western R. R.
FAYETTE S. CURTIS, Chf. Eng., N. Y., N. H. & H. R. R., New Haven, Conn.
JOHN R. FREEMAN, Boston, Mass.
FRANZ GERMANN, Colon, Isthmus of Panama.
FRANK P. KING, Asst. Chf. Eng., Denver & Rio Grande R. R., Denver, Col.
JOHN N. POTT, Mining Engineer, Wilkesbarre, Pa.
JOHN J. ROBINSON, Johnson City, Tenn.
MARTINIUS STIXRUD, Seattle, Lake Shore & Eastern R. R., Seattle, Wash. Ty.
TIMOTHY S. WHITE, Penn Bridge Co., Beaver Falls, Pa.

JUNIORS.

WM. B. EWING, Chicago, Ill.
ELSTNER FISHER, Asst. Eng., Michigan Central R. R. Detroit, Mich.
JOHN E. GRIFFITH, C. P. R. R., Donald, B. C.
CLIFFORD S. KELSEY, New York.
CURTISS MILLARD, New Croton Aqueduct, Yonkers, N. Y.
BENNO ROHNERT, Detroit, Mich.

Engineers' Club of Philadelphia.—Record of regular meeting March 16, 1889. Vice President ARTHUR BEARDSLEY, in the chair; 30 members and 4 visitors present.

Mr. J. CODMAN presented notes on "A Test of Riveted Steel and Iron Plates," exhibiting the test specimens. The iron specimens parted by fracture of the plate, and the steel specimen by shearing of the rivet.

Prof. L. M. HAUPT presented some notes upon the Permeability of Cements and Mortars, with a view of bringing out a discussion of this subject. He quoted from the recent report of the Board of Experts on the Washington Aqueduct Tunnel. That report says:

"If all of the work could and would be faithfully fulfilled in accordance with the later specifications requiring backing by masonry laid in cement mortar, it would make the tunnel reasonably water-tight; yet it would not prevent all leakage absolutely, and it is difficult to foretell how much water would pass through.

"The head of the water in the tunnel varies from about 75 to 175 ft., and the pressure due to this head from 32 to 76 lbs. per sq. in. This is an internal pressure, tending to burst the tunnel outward—a direction of force which the tunnel lining is not well adapted to resist; and in an elastic material, like brick or cement, cracks are liable to be developed on the least yielding—which would be

almost inevitable if any weak points were left in the filling. But even if it were all filled, it must be remembered that both brick and cement are permeable to water. It is well known that bricks are pervious under very ordinary pressure, and experiments have demonstrated that even the best cement is permeable to water and will allow it to percolate under pressure. Mr. JAMES B. FRANCIS, Consulting Engineer of proprietors of locks and canals in the Merrimac River, Lowell, Mass., made some recent experiments on the percolation of water through cement mortar, a record of which was presented to the American Society of Civil Engineers, May 16, 1888. These experiments showed that about 17¼ galls. of water per sq. ft. of surface passed through a thickness of nearly 16 ins. of cement in 24 hours under a pressure of 77 lbs. per sq. in. A thinner block would, of course, leak more rapidly in inverse proportion to the thickness. If the brick and cement of the tunnel were of the same thickness and leaked at the same rate, considering only half the perimeter of the tunnel, it would amount to 5,000,000 of gallons in 24 hours.

"Mr. STAUFFER'S experiments, made in the Dorchester Bay tunnel, serve to throw light on the leakage through brick-work. He constructed a bulkhead of brick, laid in cement, 4 ft. thick, in a tunnel 10 x 10 ft. He found that under a pressure of 72 lbs. per sq. in. the water percolated through at the rate of 120,000 galls. per day, or 1,200 galls. per sq. ft.

"The experience on the Boston main drainage works proved that it was not practicable to build brick masonry that was water-tight under a pressure of 64 lbs. per sq. in. At the new Croton Reservoir, New York, water under 36 ft. head was found to percolate through 26 ins. of brick-work and 4 ft. of concrete. The board of experts made some experiments to test permeability of brick and cement mortar to water under pressure. The device used in making the tests was a wrought-iron pipe, 5 ins. in diameter and about 15 ins. long, closed at both ends by caps screwed on. The cap at the bottom has in it a rectangular hole slightly smaller than the end of a brick. A heavy India rubber gasket, with the same sized opening, is placed at the bottom. In the cap on top of the pipe a smaller pipe enters, which leads from the pump. A pressure gauge is fixed to this pipe so as to indicate the pressure applied. The brick or block of cement to be tested is set upright inside the cylinder, with its end down, the upper cap being removed for that purpose. A good potter's clay is then pressed into the open space around the brick until the clay comes up to the brick. The cap is then placed on and the pump applied.

"A good, fair specimen of brick was selected from a pile at the Champlain Ave. shaft, and under a pressure of water amounting to 80 lbs. per sq. in. for one hour passed 23.4 cu. ins. of water. The same brick, under trial for a second hour, passed 21.3 cu. ins. of water. Taking the average of these two experiments, and reducing to the amount of water passed per square inch of exposed area of surface of the brick, it was found to be 2.8 cu. ins. This is equivalent to 1.75 galls. per sq. ft. of surface per hour; or for the whole interior surface of the tunnel, 27,342,000 galls. per day of 24 hours. For another selected brick, in the first hour under 80 lbs. pressure, 46.8 cu. ins. of water passed through; and for the same brick in 16 hours, under only 53.8 lbs. pressure per sq. in., 344.5 cu. in. passed—equivalent to 1.68 galls. per sq. ft. of surface per hour; or for the interior surface of the tunnel 26,248,320 galls. per day. Blocks of cement mortar were prepared, in the proportion of cement one part and sand two parts—the materials having been obtained from the stock on hand at Champlain Avenue shaft (the same as used in the tunnel). These blocks were allowed to set for 24 hours in the air, and were then placed in water, where they remained for 5 weeks.

"One of these blocks, placed in the testing apparatus, and subjected to a water pressure of 80 lbs. per sq. in. passed in a time of two and one-half hours 2,367.8 cu. ins. of water—equivalent to 73.8 galls. per sq. ft. of surface per hour—very far beyond the amount of percolation given by brick. A second experiment, under 58 lbs. pressure per sq. in. for one and a half hours, gave a percolation of 874.8 cu. in. of water—equivalent to 45.5 galls. per hour per sq. ft. of surface. It is to be noticed from the experiments of Mr. FRANCIS that Portland cement mortar, having the same proportions of material as in this case, did not transmit the water nearly so rapidly. This was owing in a great degree to the cement; but probably partially to the difference in the quality of the sand, as the sand here used was not of the very first quality. The cement bricks presented an appearance of great porosity; and the result was not altogether unexpected.

"It is to be regretted that the time at the disposal of the Board would not allow extensive and conclusive experiments on this subject."

Mr. JOHN E. CODMAN presented a description of the compound steam turbine and turbo-electric generator derived from a paper presented by Hon. CHAS. A. PARSONS to the Institution of Mechanical Engineers of England. A high degree of economy in the use of steam simplicity, and high speed are claimed for this mechanical novelty.

HOWARD MURPHY,
Sec. and Treas

The State Electric Society has elected the following officers: President, Dr. L. H. SMITH, Buffalo; Vice-President, D. G. W. KING, Kings Station; Secretary, Dr. J. A. BAUERMANN, New York; Treasurer, MILTON M. FEUNER, Fredonia; Corresponding Secretary, E. B. FOOTS, Sr., Worcester; Board of Censors, Drs. R. A. GUNN, New York, C. COLLINS, Middleburgh, L. DE TENOGE, Liberty, R. HAMILTON, Saratoga, C. W. PARKER, Cortland, J. W. BETTS, Pulaski, W. H. HAWLEY, Penn Yan, J. H. DYE, Buffalo, and O. A. HYDE of the Electric College, New York. The next meeting will be held in Albany.

The American Water-Works Association will hold its annual meeting at Louisville, Ky., on April 16, 17, 18, prox. After the regular business of the Association is transacted the following papers are announced as to be read before the several meetings:

"Water-Works Records," J. M. DIVEN; "Flushing Street Mains," H. W. AYRES; "Increased Revenue from Private Sources," C. N. PRIDDY; "Hydraulic Elevator Operated by Direct Pressure," G. A. ELLIS; "Use of Liquid and Gaseous Fuel," L. H. GARDNER; "Pressure Regulators for Water-Works," WILLIAM RYLE; "Analysis of Mechanical Filter Actions," EMILE GEYELINS; "Water-Works Construction from an Engineering, Financial, and Municipal Point of View," F. H. POND; "Classification of Water-Rates," J. NELSON TUBBS; "Purification of Water for Boilers," F. W. GERECKE; "Standard Water Pipes," D. B. RUSSELL; "Aeration and Sedimentation of Muddy River Water," Prof. J. B. JOHNSON; "The Hardness of Water," Prof. A. R. LEEDS; "Relation Between Plumbers and Water Companies and Departments," B. F. JONES; "Some of the Difficulties in Establishing a new Public Water-Supply and its Improvement," W. J. MILNER.

Special arrangements have been made for the exhibition at the meeting of water-works appliances manufactured or dealt in by the Associate Members of the Association, and all such members are requested to send exhibits, and all manufacturers interested who are not members are cordially invited to join and send their applications to the Louisville meeting. Such applications will at once receive attention if sent to Mr. J. H. DECKER, Secretary, Salina, Kan. The Committee for the coming meeting is a guarantee of the interest taken and the good promise for success, being made up of J. M. DIVEN, Elmira, N. Y.; WM. RYLE, Paterson, N. J.; Dennis Long & Co., Louisville, Ky.; Addyston Pipe & Steel Co., Cincinnati, O.; and the Ohio Pipe Co., of Columbus, O. The headquarters will be at the Galt House.

Master Mechanics' Association.—A circular as to the advantage or otherwise of using thick tires has been issued asking (1) for a tabulated statement showing the mileage made during the lifetime of a series of heavy and light tires; (2) any figures showing the amount of wear to tires occasioned in handling engines by different engineers. (3) Whether heavy wheel centers with thick tires produced flat spots upon the tread of tires sooner than light wheel centers with light tires; etc.

Replies to be sent to HENRY SCHLACKS, Superintendent Machinery, Illinois Central R. R., Chicago, Ill.

Another circular asks if the water space surrounding fire box and flues of locomotives is usually large enough for free circulation. It states that the average amount of steam evaporated from a given amount of coal burned is usually, in the ordinary locomotive boiler, only about half of what a perfect utilization of the heating properties of the coal should accomplish. It is believed that much of this waste of heat is due to a restricted circulation of water in the boiler; that is, owing to inadequate passages for the water, the latter is unable, under certain conditions, to maintain its continuity with the heated sheets.

To the end that this subject be investigated, and that a report be made based on practical results, the committee asks a series of specific questions as to different points of the boiler, which the general subject naturally suggests, and also for any further information relating to the subjects.

Replies to be sent to JOHN HICKEY, M. M., Mil., L. S. & W. Ry., Kaukauna, Wis.

New England Railroad Club.—At the regular monthly meeting of the club at Boston, Mass., on April 10, the subject for discussion will be "The Compound Locomotive." The subject being a new one for America, it is thought it will be very entertaining, and draw a large attendance.

FRANCIS M. CURTIS,
Secretary and Treasurer.

Statistics of Railway Construction.
States East of Chicago.

(Concluded from page 296.)

OHIO.—Existing Roads.

139. ***Cincinnati, Hamilton & Dayton.***—Track laid, McComb to Findlay, 8.8 miles. Graded, Wyoming to Lockland, 0.7 miles.

140. ***Cincinnati, Jackson & Mackinaw.***—Track laid, Carlisle to Franklin, 3 miles.

141. ***Cleveland & Canton.***—Track laid, Solon to South Solon, 3 miles. Track laid since Jan. 1, 1889, at Kent to connect with Pittsburg & Western R. R. 0.7 miles; Coshocton to Zanesville, 30 miles. Under construction, Wheeling to Bowerstown, 50 miles.

142. ***Cleveland, Akron & Columbus.***—Track laid, section 23 to Dresden Jc., 11 miles.

143. ***Columbus, Lima & Milwaukee.***—Under contract, Columbus to Defiance, 115 miles. Under survey, Defiance to Saugatuck, Mich., 145 miles. Projected, Columbus to Marietta, 87 miles. President, R. C. Faurot; Chief Engineer, Samuel Craig; both of Lima, O. Contractor, Stephen G. Clarke, 1525 No. Halstead St., Chicago.

144. ***Lake Erie, Alliance & Southern.***—Projected, Canton to Paris, 11 miles.

145. ***Lake Erie & Western.***—Projected, Minster to Piqua, 20 miles.

146. ***Lancaster & Hamden.***—Under contract, Lancaster to Point Pleasant, 76 miles. Under survey, Cedar Falls to Elco Coal Mines, 12 miles. Projected, Lancaster to Hadley Jct., 11 miles. Contractors, E. P. Buell & Co., Lancaster, O.

147. ***Marietta, Columbus & Northern.***—Track laid, Big Run to Stewart, 5 miles. Under construction, Amesville to Toledo & Ohio Central R. R., 13.5 miles.

148. ***New York & Ohio.***—Under construction, Hudson, O., to Greenville, Pa., 75 miles. President, D. M. Yeomans, 35 Wall St., New York City. Vice-President, Horace Scott, Louisville, Ky.

149. ***New York, Mahoning & Western.***—Track laid, Findlay to Ottawa, 20.2 miles. Under construction, Ottawa to Fort Wayne, Ind., 60 miles. President, Wm. Thorpe, 42 New St., New York City. General Manager, C. N. Haskell, Ottawa, O.

150. ***Ohio & Northwestern.***—Track laid, Portsmouth to Sciotoville, 5 miles. Projected, Sciotoville to Gallipolis, 49 miles. —Columbus & Maysville, projected, Sardinia to Ripley, 22 miles.

97. ***Pennsylvania.***—Cincinnati & Richmond.—Track laid, Red Bank to Hamilton, 27 miles. Projected, Hamilton to Richmond, Ind., 45 miles.

151. ***Pittsburg, Akron & Western.***—Located, Akron, to Carey, 110 miles. President, Wm. Sempie, Pres. Cleveland & Western Ry., Allegheny City, Pa.

152. ***Pomeroy, Middleport & Syracuse.***—Under construction, Middleport Station to Syracuse, 9.2 miles. Secretary, T. Wm. Harris, 44 Broadway, New York. Chief Engineer, Jas. S. C. Taber, Pomeroy, O.

153. ***Port Clinton Short Line.***—Graded, Port Clinton to Fremont, 20 miles. President, E. H. Brennan, Port Clinton, Ohio.

154. ***Toledo, Columbus & Southern.***—Track laid, Findlay to South Findlay, 6 miles. Projected, South Findlay to Milford, 57 miles.

155. ***Wheeling & Lake Erie.***—Under construction, Bowerstown, Ohio, to Wheeling, W. Va., 40 miles.

156 ***Zanesville & Ohio River.***—Track laid, Waterford to Harmar, 23 miles. Shawnee & Muskingum Valley, track laid, Shawnee Jct. to Corning and Buckingham to Shawnee, 21 miles. Under construction, 5 miles.

Projects and Surveys.

157. ***Black Diamond.***—Zanesville, Mt. Vernon & Marion, surveyed, Zanesville to Marion, 85 miles. Projected, Zanesville to Richmond, 200 miles. Albert E. Boone, Zanesville.

158. ***Cleveland & Chicago.***—Projected, Fremont to Napoleon, 53 miles. General Manager, Isaac Reynolds, Cleveland.

159. ***Dayton & Lebanon.***—Projected, Dayton to Lebanon, 23 miles. Wm. Huffmann, Dayton, O.

160. ***Jefferson & Columbiana.***—Projected, Portland to Steubenville, 15 miles. President, W. B. Donaldson, Steubenville.

161. ***Sandusky, Ashland & Coshocton.***—Located Sandusky to Coshocton, 93 miles. W. D. Crane, Sandusky, O.

162. ***Tiffin & Fremont.***—Located, Marblehead to Upper Sandusky, 65 miles. President, J. O. Sloan, Chief Engineer, J. G. Kaney, Toledo.

163. ***Zanesville, Newcomerstown & Cleveland.***—Surveyed, Zanesville to Mineral City, 72.5 miles. President Willis Bailey; General Manager, Edmund Turner; both of Zanesville.

Total.—Track laid, 133 miles; track laid since Jan. 1, 1889, 30.7 miles; under construction, 426 miles; under survey, 593 miles; projected, 593 miles.

INDIANA.—Existing Roads.

164. ***Canada & St. Louis.***—Track laid, Goshen to Michigan State line, 36 miles. Projected, Goshen, Ind. to Danville, Ill., 135 miles. Receiver, Thos. A. Starr, Goshen Ind.

165. ***Chicago & Calumet Terminal.***—Track laid, Whitney, Ind., to Illinois State line, 5 miles. Gen. J. T. Torrence, Chicago, Ill.

166. ***Chicago & Eastern Illinois.***—Track laid, Percy Jct. to Illinois State line, 21.2 miles.

167. ***Cincinnati, Indianapolis, St. Louis & Chicago.***—Projected, Aurora, Ind., to Louisville, Ky., 86 miles; Columbus to Switz City, 70 miles.

168. ***Cincinnati, Wabash & Michigan.***—Surveyed, Anderson to Rushville, 40 miles.

169. ***Elgin, Joliet & Eastern.***—Track laid, Illinois State line to McCool, 23.5 miles.

170. ***Evansville & Terre Haute.***—Evansville & Richmond. Under construction, Elnora to Bedford, 40 miles. Projected, Bedford to Richmond, 115 miles. Contractors, Oliver Ferguson & Co., Bedford.

171. ***Evansville, Fort Wayne & Chicago.***—Under contract, Fort Wayne to Lafayette, 109 miles; President, H. E. Drew, Indianapolis. Contractors, Keene Bros. Construction Co., 611 No. Main St., St. Louis, Mo.

172. ***Evansville, Suburban & Newburg.***—Under contract, Evansville east, 5 miles. Under survey, to Newburg, 11 miles. President, Lu. Howell; Chief Engineer, B. A. Wood; both of Evansville.

173. ***Indiana & Illinois Southern.***—Projected, 6 miles east of Sullivan to Indianapolis, 80 miles.

174. ***Indiana, Illinois & Iowa.***—Projected, Knox to South Bend, 33 miles.

175. ***Louisville, Evansville & St. Louis.***—Huntingburg, Tell City & Cannelton, track laid, in Cannelton, 0.41 miles.

176. ***Louisville, New Albany & Chicago.***—Surveyed, French Lick Springs to Jasper, 24 miles; Bainbridge to Clay county line, 32 miles; City limits to Indianapolis Depot, 3 miles.

177. ***Louisville, New Albany & Corydon.***—Under construction, Corydon to King's Cove, 4 miles.

178. ***Midland Ry. of Indiana.***—Track laid, Ladoga to near Brown's Valley, 10 miles. Projected, end of track to Paris, Ill., 50 miles.

97. ***Pennsylvania.***—Projected, Logansport to Royal Center, 10 miles. (A change of line to secure lighter grades. The old line will will be abandoned.)

179. ***Vincennes & New Albany.***—Under contract Vincennes to New Albany, 125 miles. President, Edward Watson, Vincennes.

Projects and Surveys.

Atlantic & Mississippi.—Projected, Fort Wayne to St. Louis, Mo., 500 miles. President, J. H. Cable, Lafayette.

180. ***Chicago, Dayton & Cincinnati*** — Surveyed, Huntington to Versailles, O., 65 miles. President, L. P. Milligan; Chief Engineer, Geo. G. Pride; both of Huntington, Ind.

181. ***Chicago, Lodi & Southeastern.*** — Projected, Covington to Terre Haute, 54 miles; Lodi to Brazil, 36 miles. President, John J. Safely, Lodi, Park County, Ind.

182. ***Elkhart & Western***—Located, Elkhart to Mishawaka, 10 miles. President, H. E. Bucklin, 275 Michigan Ave., Chicago, Ill. Chief Engineer, E. C. Bickel, Elkhart, Ind.

Montpelier & Chicago. — Projected, Montpelier, O., to Chicago, Ill., 210 miles. President, D. Stauffer, Montpelier, O.

183. ***Seymour & Southwestern.***—Projected, Seymour to Jasper, 70 miles. Secretary, Louis Schenck, Seymour, Ind.

Toledo & Chicago Air Line.—Projected, Toledo, O., to Chicago, Ill., 225 miles. President, M. Mercer, Goshen, Ind.

184. ***Vincennes, Oakland City & Owensboro.***—Surveyed, Vincennes, Ind., to Owensboro, Ky., 70 miles. President, Jas. C. Rudd; Chief Engineer, W. B. Eells; both of Owensboro, Ky.

Total.—Track laid, 86.1 miles; under construction, 307 miles; under survey, 237 miles; projected, 724 miles.

MICHIGAN—Existing Roads.

164. ***Battle Creek & Bay City.***—Track laid, West Bay City to Midland, 18 miles. Surveyed, Midland to Battle Creek, 92 miles. Receiver, W. A. Ackerman; General Superintendent, W. Irving Fox, Battle Creek.

165. ***Canada & St. Louis.***—Track laid, Indiana State line to Battle Creek, Mich., 42 miles. (Officers same as preceding.)

185. ***Central Michigan.***—Under survey, Rogers City, Mich. to Coldwater, Mich., 350 miles. President, J. W. Boynton; Chief Engineer, J. H. Roberts; both of Grand Rapids, Mich.

Chicago & Northwestern.—Track laid, Ishpeming to Michigamme and Republic, 32.19 miles.

186. ***Chicago & West Michigan.***—Surveyed, Baldwin to Traverse City, 75 miles.

187. ***Chicago, Kalamazoo & Saginaw.***—Under construction, Hastings to Portland, 25 miles. Surveyed, Portland to Saginaw, 70 miles. Chief Engineer, Frank C. Balch, Kalamazoo, Mich.

140. ***Cincinnati, Jackson & Mackinaw.***—Surveyed, Addison to Jackson, 7 miles; Allegan to Saugatuck, 26 miles.

188. ***Detroit, Lansing & Northern.***—Track laid, Mulliken to Thornapple River, 32 miles.

Duluth, South Shore & Atlantic.— Track laid, Bessemer branch, 10 miles.

189. ***Flint & Pere Marquette.*** — Track laid, Manistee branch, spur lines, 3.16 miles; Jackson, Lansing & Saginaw Jct. to South Saginaw, 6 miles; Flint & Pere Marquette depot to Bay City branch, 2.11 miles; Coleman to South Cedar, 2.55 miles; J. L. & S. Jct. to Zilwaukee, 2 miles. Projected, Northville to Detroit, 22 miles.

190. ***Manistee & Northeastern.***—Track laid, main line to Onekama, 3 miles; Manistee northeast, 25 miles. Under construction, end of track to Traverse City, 50 miles; Bear Creek east, 7 miles. Projected, Long Lake to Lake Michigan, 30 miles. President, Edward Buckley, Manistee.

Michigan Central.—Track laid, 3d St. Station, Detroit to Beaufort St. Station, 4 miles.

97. ***Pennsylvania.***—Grand Rapids & Indiana, under survey, end of track to Ludington, 49 miles.

191. ***Toledo, Ann Arbor & North Michigan.***—Track laid, Cadillac to Springville, 20 miles. Under construction, Mt. Pleasant to Big Rapids, 40 miles; Springville to Frankfort, 43 miles. Under survey, Clare to Alger, 40 miles; Manistee Jct. to Traverse City, 55 miles; Manistee, Jct. to Manistee, 20 miles. Projected, Traverse City to St. Ignace, 90 miles; Mackinaw City to Alpena, 95 miles.

192. ***Toledo, Saginaw & Mackinaw.***—Track laid, Durand to East Saginaw, 39.2 miles. Vice-President, P. H. Ketcham, East Saginaw, Mich.

Projects and Surveys.

193. ***Detroit & St. Clair River.***—Surveyed Detroit to St. Clair, 43 miles. President, C. McElroy, St. Clair.

Northern Michigan.—Surveyed Houghton to Watersmeet, 70 miles. Chief Engineer, Chas. S. Robinson, Vice President and General Manager, C. A. Wright, both of Hancock.

194. ***St. Ignace & Sault Ste. Marie.***—Surveyed, St. Ignace to Sault Ste. Marie, 53 miles. President, Wm. Chandler; Chief Engineer, George Cox; both of Sault Ste. Marie.

Total.—Track laid, 241.2 miles: under construction, 165 miles; under survey, 1,065 miles; projected, 237 miles.

VIRGINIA.—Existing Roads.

195. ***Craig Mineral.***—Under construction, Eagle Rock to New Castle, 25 miles. Projected, New Castle to New River, 35 miles; New Castle to Roanoke, 28 miles. President, J. W. Marshall, New Castle. General Manager, W. G. Sears, Eagle Rock. Chief Engineer, F. A. Cooper, Eagle Rock.

196. ***Farmville & Powhatan.***—Under construction, Clover Hill to Farmville, 59 miles. President, Jas. Hobson, Rock Castle, Va. Chief Engineer, H. A. Whiting, Powhatan, C. H., Va.

197. ***Lynchburg & Durham.***—Track laid, Lynchburg to Rustburg, 11 miles. Under construction, Rustburg to Durham, N. C., 92 miles. President, P. J. Otey; Chief Engineer, J. W. Goodwin; both of Lynchburg.

198. ***Norfolk & Western.***—Track laid, near Graham to end of track, 23.5 miles; Flat Top extension, 10.69 miles; Cripple creek extension, 2.52 miles; branch from main line, 0.66 miles.

Projects and Surveys.

199. ***Alexandria & Charleston.***—Projected, Alexandria, Va., to Charleston, W. Va., 240 miles. Secretary, John R. Reaves, Alexandria, Va.

200. ***Staunton & West Augusta.***—Projected, Staunton to West Augusta, 30 miles. John D. Crowle, Staunton, Va.

201. ***Washington, Western & Southwestern.***—Projected, Warrenton to Luray, 50 miles. Secretary, Jas. A. Jeffries, Warrenton.

Total.—(Of lines in the above list shown on the map.) Track laid, 48.4 miles; under construction, 104 miles; projected, 273 miles. (The totals for the whole State will be given in connection with the map and list of the Southern States.)

WEST VIRGINIA.—Existing Roads.

95. ***Baltimore & Ohio.***—Berkeley Springs & Potomac, Track laid, Hancock, Md., to Berkeley Springs, W. Va., 6 miles.

202. ***Kanawha & Ohio.***—Track laid, 2 miles south of Charleston, south, 4.5 miles. Under construction, Campbell's Creek to Walden, 2 miles. Projected, end of track to a connection with the Norfolk & Western, 80 miles.

203. ***Kingwood & Tunnelton.***—Track laid, end of track to Kingwood, 2 miles. Projected, Kingwood to Fairchance, Pa., 17 miles.

203½. ***Martinsburg & Potomac.***—Under construction, Martinsburg, W. Va., to Winchester, Va., 22.5 miles.

196. ***Norfolk & Western.***—West Virginia & Ironton, Located, Forks of Elkhorn to near Ironton, O., 185 miles.

204. ***Ohio River.***—Ripley & Mill Creek Valley, track laid, Ripley, C. H. to main line, 13 miles. Projected, Ravenswood to Spencer, 28 miles; Fairmont to New Martinsville, 51 miles.

205. ***West Virginia Central.***—Track laid, Harrison to Elk Garden, 7 miles; Big Run to Parsons, 7 miles. Track laid since Jan. 1, 1889, Parsons to Messenger's, 1.5 miles. Under construction, New Interest to Elkins, 8 miles. Under survey, Elkins to Ohio River, 150 miles.

Projects and Surveys.

157. ***Black Diamond.***—Virginia, Parkersburg & Ohio, projected, Parkersburg, W. Va. to Clifton Forge, Va., 150 miles. President, Perry G. Marshall; Chief Engineer, B. E. Cutler; both of Zanesville, O.

206. ***Buckhannon.***—Projected, Buckhannon to Three Forks, 10 miles. President, J. N. Camden, Parkersburg.

Cumberland, Moorefield & West Virginia.—Projected, Cumberland, Md. to Moorefield, W. Va., 50 miles. Chief Engineer, J. P. Gaffney, Cumberland, Md.

207. ***Huntington & Guyandotte River.***—Under survey, Huntington to Logan, C. H., 34 miles. Projected, Logan, C. H. southeast, 66 miles. President, J. L. Caldwell, Huntington.

208. ***Monongahela River.***—Under survey, Fairmont to Clarksburg, 35 miles. President, J. N. Camden, Parkersburg.

209. ***St. Albans & Coal River.***—Projected, St. Albans to Coal River marshes, 45 miles. John Cunningham, St. Albans.

210. ***Weston & Elk River.*** — Projected, Weston to Sutton, 30 miles. J. N. Camden, Parkersburg.

211. ***West Virginia & Pennsylvania.***—Projected, Rowlesburg to Pennsylvania State line, 27 miles. W. M. A. Dawson, Kingwood, W. Va.

134. ***Wheeling, Wellsburg & State Line.***—Surveyed, Wheeling to Pennsylvania State line, 25 miles. President, Samuel George, Wellsburg; Secretary, A. B. Paul, Hopedale, O.

Total.—Track laid, 40 miles; track laid since Jan. 1, 1889, 1.5 miles; under construction, 24 miles; under survey, 412 miles; projected, 600 miles.

KENTUCKY.—Existing Roads.

212. ***Charleston, Cincinnati & Chicago.***—Under contract, White House to Breaks of Sandy, 90 miles. Contractors, McDonald, Shea & Co., Knoxville, Tenn.

213. ***Cincinnati & Green River.***—Projected Yosemite to a connection with the Louisville & Nashville R. R., 55 miles.

214. ***Covington Transfer.*** — Under construction, Covington to Ludlow, 2 miles. Chief Engineer, D. Bouscaren, Covington, Ky.

215. ***Kentucky Midland.***—Track laid since Jan. 1, 1889, Frankfort to Buffalo Trace, 2 miles. Under construction, Frankfort to Paris, 40 miles. Under survey, Paris to Prestonburg, 100 miles. Projected, North Middleton to near Winchester, 9 miles. President, Wm. Lindsay. Chief Engineer, J. M. Douglas, both of Frankfort, Ky.

216. ***Kentucky Union.***—Under construction, Lexington to Jackson, 85 miles. Projected, Jackson to Big Stone, Va., 50 miles.

217. ***Louisville & Nashville.***—Under survey, Alum Springs to Shelby City, 10 miles.

218. ***Louisville, Hardinsburg & Western.*** — Under contract, Irvington to Fordsville, 40 miles. President, B. F. Beard, Hardinsburg; Chief Engineer, C. L. Cornwall, Louisville, Contractors, Marshall Morris & Co., Louisville.

219. ***Louisville, St. Louis & Texas.***—Track laid, West Point to Henderson, 142 miles. — Breckinridge, Ry. located, Victoria to Fordsville, 14 miles.

220. ***Louisville Southern.***—Track laid, Louisville to Burgin, 83 miles; Midway to Georgetown, 10 miles. Under construction, Burgin to Danville, 4.5; Lawrenceburg to Lexington, 24 miles; Versailles to Beattyville, 80 miles.

221. ***Maysville & Big Sandy.***—Track laid, Between Ashland and Covington, 93 miles. Chief Engineer, Chas. B. Childe, Maysville, Ky.

222. ***Newport News & Mississippi Valley.*** —Elizabethtown & Hodgdenville, track laid, Elizabethtown to Hodgdenville, 11.1 miles.

223. ***Ohio Valley.***— Under construction, Henderson to Evansville, 10 miles.

224. ***Owensboro, Falls of Rough & Green River.***— Under contract, Owensboro to Falls of Rough, 38 miles. President, Henry C. Herr; Chief Engineer, James Nunan; both of Owensboro. Contractor J. W. M. Field, Owensboro.

Projects and Surveys.

225. ***Bowling Green & Northern.***—Projected, Litchfield to Bowling Green, 40 miles. Secretary, W. H. Cramp, Bowling Green.

226. ***Bowling Green, Hartford & Ohio River.*** — Projected, Bowling Green to Evansville, Ind., 95 miles. President, Laban M. Rice, Evansville, Ind. Vice-President, E. T. Leonard, Peoria, Ill.

227. ***Hawesville & Pellville Mineral.*** — Projected, Hawesville to Beaver Dam, 40 miles. President, D. L. Adair, Hawesville.

228. ***Henderson State Line.***—Projected, Henderson, Ky., to Chattanooga, Tenn., 240 miles. President, S. K. Sneed, Henderson.

229. ***Louisville, Cincinnati & Virginia.***—Projected, Winchester to Beattyville, 50 miles. President, Douglas Green, 78 Broadway, New York City.

230. ***Paintsville & Licking Valley.*** — Projected, Paintsville to Salyersville, 18 miles. President, John F. Hogar, Ashland; Secretary, J. F. Stewart, Paintsville.

Total.—(Of lines in the above list shown on the map.) Track laid, 339 miles; track laid since Jan. 1, 1889, 2 miles; under contract or construction, 410 miles; surveys, 124 miles; projected, 457 miles. (The total for the whole State will be given in connection with the map and list of the Southern States.)

RAILWAYS.

EAST OF CHICAGO.—Existing Roads.

Lehigh Valley —A correspondent calls our attention to the omission on last week's map and list of the Jordan loop line, 2 miles in length, double track, now under construction from a point on the Lehigh Valley main line ½ mile west of Furnace station to a point on the main line in Allentown, Pa.

New York, Mahoning & Western.—This company seems to be in continual warfare with some one or other. The latest is a disputed crossing over the Lake Erie & Western track at Findlay, O. After several unsuccessful attempts, 100 employés of the Mahoning road on March 31 made a rush for the crossing just after the Lake Erie & Western fast train had passed and succeeded in laying the crossing before the opposing side could muster its forces.

Western Counties.—Bids close Monday, April 8, at the Department of Railways & Canals, Ottawa, Ont., for grading this railway between Annapolis and Digby, Nova Scotia.

Port Clinton Short Line.—The city of Port Clinton O., has voted $15,000 to this enterprise.

Hudson Suspension Bridge & New England.—The survey has just been completed for a line from the west end of Bull Hill tunnel to the New York, Ontario & Western road, a little less than 7 miles.

Schuylkill & Lehigh.—A large force has begun work on this road, near Schuylkill Haven, Pa. At this point the road will cross the Reading and Pennsylvania railways and the Schuylkill canal and river by a high bridge and viaduct.

Port Jervis, Monticello & New York.—The new 18-mile extension from Huguenot to Summitville, built last season, was opened for business on April 1.

Buffalo, Rochester & Pittsburg.—J. E. McIntyre, of Buffalo, N. Y., has been awarded the contract for the timber work on the Lincoln Park & Charlotte Railway. There will be required 1,500,000 ft. of timber and 1,300 piles.

Flint & Pere Marquette.—On April 1 this company assumed control of the Port Huron & Northwestern system. The officers will be the same as the present officers of the Flint & Pere Marquette. The company has recently marketed $1,000,000 5 per cent. 50 year bonds which sold at about par. The proceeds are to be used to take up a floating debt of about $400,000, due to recent construction, and to build the extension to Detroit shown on our map in last week's issue.

Western Maryland.—The Western Maryland Tidewater Railroad Company has been chartered in this company's interest to build an extension about 7 miles in length to an independent terminus on Baltimore harbor. The cost of construction exclusive of real estate is estimated at $280,163. The company is now seeking a franchise for this line from the Baltimore City Councils.

Philadelphia & Reading.—It is reported that a contract for the proposed road from Winslow Jc., to Cape May, N. J., 35 miles, has been let to WALTER WOOD, of Philadelphia. Among those closely interested in pushing the new line are THOS. M. THOMPSON, JOHN H. BETZ and THEODORE WALTON, of Philadelphia. $200,000 is already subscribed for the work.

Boston & Albany.—Governor AMES has signed the bill permitting the increase of capital stock from $20,000,000 to $30,000,000.

Concord.—The directors of the Suncook Valley Railroad have voted to build the extension from Pittsfield to Barnstead, N. H., at an early date.

Temiscouata.—A branch has been surveyed from Edmunston, N. B., southwest via Fort Kent to the junction of the St. Francis and St. John's rivers, about 35 miles.

Toledo, Saginaw & Mackinaw.—It is reported that the Toledo, Ann Arbor & North Michigan Company will cease operating this line on July 1, and that the Grand Trunk will assume its control.

Evansville & Terre Haute.—Grading has begun on the Evansville & Richmond road at Richmond, Ind., under contractors, Oliver Ferguson & Co.

Cleveland, Cincinnati, Chicago, & St. Louis.—Meetings are to be called about May 15, of the stockholders of the several companies to ratify the Bee Line and Big Four consolidation to form a new company with this unwieldy name.

Projects and Surveys.

Peru & Detroit.—Incorporated in Indiana to build a line of railway from Peru to Laketon, where it will connect with the Wabash Western Ry., a distance of 25 miles. Among the directors are, RICHARD F. DONALDSON, L. B. FULWILLER, W. C. RAYMOND, and CHAS. H. BROWNELL.

Rochester, Beaver Falls & Western.—Incorporated in Pennsylvania to build a railway from a point on the Pittsburg & Western R. R. in Wayne township, Lawrence county, via Beaver Falls and New Brighton to Rochester, Beaver county, a distance of 15 miles. JOHN REAVES, of Beaver Falls, is President.

Rochester & Coudersport.—There is considerable talk of forming a through line from Rochester, N. Y. to Coudersport, Pa., by extending the Rochester & Honeoye Valley R. R. to a connection with the Lackawanna & Pittsburg R. R., at Perkinsville, and with the proposed Hornellsville & West Union and the Coudersport, Hornellsville & Lackawanna Railroads. This will give practically a continuous line, about 120 miles long, between the two places.

SOUTHERN. Existing Roads.

Apopka, Clay Springs & Gulf.—The Pierce & Torry Investment Co., of Orlando, Fla., write us that tracklaying will begin on this line about May 1. It is being graded by C. Waters, of Apopka and will be 5 miles in length, from Clay Springs to Apopka. The line will furnish a new outlet from Clay Springs to Jacksonville via the Wekiva river, which is to be made navigable shortly. The principal traffic will be in lumber, but passengers will also be carried.

Richmond, Fredericksburg & Potomac.—For the 8 mile connecting link with the Richmond & Petersburg R. R., near Richmond, the contract for grading and masonry has been let to A. W. Harman & Co.; for bridge masonry to Mason Hoge & Thrasher; and for the superstructure of the bridge across the James river to the Edge Moor Iron Co.

Atlanta & Florida.—The stockholders of this company have made an arrangement with the Americus Investment Company, controlling the Savannah, Americus & Montgomery Railway, by which the Atlanta & Florida will be extended south to Cordele and will form part of the S. A. & M. system. It is believed that the system will also be extended east to Savannah and west to Montgomery, Ala.

Richmond & Danville,—Grading is completed on the High Point, Randleman, Asheboro & Southern Railroad from High Point to Asheboro. On the Murphy branch of the Western North Caro ina road, 11 wooden bridges are to be replaced with iron structures this season.

Genesis & Obed River.—Grading is in progress on a line 15 miles in length from Genesis, Tenn., northeast to Sunbright, 15 miles. J. B. HOLMES of Genesis, Tenn., is Chief Engineer.

Charleston, Cincinnati & Chicago.—Engineer A. M. MOLESWORTH will begin within a few days a resurvey of the division between Blacksburg and Newberry, S. C., of the old Augusta, Edgefield & Newberry road, purchased by the company two years ago.

St. Augustine & Halifax.—The change of gauge of this Florida road, extending from East Palatka to Daytowa, 60 miles was made in 18 hours by a force of about 275 men under W. J. JARVIS and W. T. CRAWFORD.

Louisville Southern.—About 2,000 men are at work grading the extension between Lawrenceburg and Lexington.——On the Richmond, Nicholasville, Irvine & Beattyville road, Messrs. D. Shanahan & Co. are pushing work on their contract. D. A. SHANAHAN has charge of the head office at Nicholasville, C. M. SHANAHAN is supervising work on the Kentucky river bridge. E. P. POWELL has charge of the Madison County tunnel, and M. H. MCCARTHY is directing the construction of the Kentucky bridge approaches on the Jessamine county side. J. H. PEARSONS is Chief Engineer; T. S. ROCK, Acting Division Engineer; and Messrs. ZOLLINGER, DOUGHERTY, and YEAGER are the Resident Engineers.

Ohio Valley.—The company is collecting tools and material at Princeton, Ky., for use on the extension to Hopkinsville. It is now planned to continue the extension eventually to Nashville.

Norfolk & Western.—By a mistake in the types in our issue of March 16, HENRY DAVIN, contractor on the Clinch Valley extension was referred to as HENRY DAVIES.——The statement of February earnings on the system shows an increase of 15 per cent. in gross earnings, 21 per cent. in in expenses, and 4 per cent. in net earnings over 1888.

Georgia Pacific.—Trains are expected to be running to Greenville, Miss., by June 1. Work will be continued at once on the extension up the east bank of the Mississippi to a point opposite Arkansas City, Ark.

Green Pond, Walterboro & Branchville.—It is proposed to extend this South Carolina road to Bell's Crossroads and thence in the direction of Barnwell.

Alabama Midland.—About 85 miles are graded and 15 miles of track are laid on this road, which is to extend from Montgomery, Ala., southeast to Bainbridge, Ga., where connection is made with the Plant system. The company has offered to extend the line from Montgomery to Tuscaloosa, Ala., if that city will subscribe $90,000. It is expected that regular trains will be running over the Georgia division from Bainbridge to the Chattahoochee river, 33 miles, by April 20; and that the whole line to Montgomery will be in operation by September 15.

Chattanooga Southern.—A contract for 5 miles of this road has been let and ground was broken on March 28, at the State line between Tennessee and Georgia, the graders working toward McLemore's Cove.

Gulf & Ship Island.—Tracklaying has been resumed on an extension from Gulfport, Miss., to the Gulf.

Carolina, Cumberland Gap & Chicago.—There is some prospect that this company will purchase the franchises and partly built line of the Carolina, Knoxville & Western company.

Owensboro, Falls of Rough & Green River.—The company has issued bonds to the amount of $560,000 secured to the Holland Trust Company of New York as trustees. Several hundred hands are at work on the grading near Whitesville, Daviess county, KY. H. C. HERR, of Owensboro, is President, and GEO. V. TRIPLETT is Secretary.

Chesapeake & Nasheville.—The stockholders of the Middle & East Tennessee Central Railway are considering a proposal to transfer the partly graded roadbed of their line to this company, which proposes to complete the line from Gallatin to Hartsville.

Darien Short Line.—Tracklaying is to begin on this Georgia road in a short time. It is to run from Darien north to some point on the Savannah, Americus & Montgomery extension. About 40 miles are nearly graded. R. H. WALKER, of Darien, is President and WM. VARNEDOE is General Manager.

Projects and Surveys.

Meridian & Tuscahoma.—The following information has been sent us by the President of the company, W. H. HARDY, of Meridian, Miss.

The surveys have been completed for this road, which is to run from Meridian, Miss., via Pushmataha and Butler to Tuscahoma, Ala., 45.7 miles, forming a connection between Meridian and the steamer lines on the Tombigbee river. The work is light; maximum grade, 1 per cent. and maximum curve 4°. The route is through a fine agricultural country, fertile and well timbered, and the road will have a large business in agricultural products, timber and coal. The right of way has generally been given free of cost and no other local aid has been asked for. The building of this road will bring Meridian as a competing point within the ruling of the Interstate Commission on the "long and short haul" clause of the Interstate Commerce Law, a position which she does not now occupy. Major WEEKS, of Meridian, Miss., is Chief Engineer.

Bluefield & Hinton.—Incorporated in West Virginia to build a line of railway from a point near Bluefield to a point near Hinton. Among the incorporators are A. W. REYNOLDS, of Bluefield, W. Va., C. H. DUHRING, Jr., of Coopers, W. Va., and J. A. WALCH, of Bramwell, W. Va. The principal offices will be at Bluefield.

Memphis Belt Line & Suburban.—This company has been chartered in Tennessee to build a railway from Magnolia Station, on the Kansas City, Memphis & Birmingham R. R., near Memphis, to Raleigh, Shelby county, and from a point on the Wolfe river near the water; works to a convenient junction with the other line. Among the incorporators are JOHN SHEA, GEO. W. PALLAHAN, H. J. ENGLESING, and H. H. PLANT.

Etowah Valley.—This company was organized in 1884 to build a railway from Dawsonville, Ga, to a connection with the Gainesville & Dahlonega R. R., a distance of 10 miles, and 5 miles was graded when the work ceased. The company has been reorganized and proposes to build this 10 miles at once with a view of extending the road to Kingston, Ga. P. B. LAWRENCE, of Atlanta, Ga., is President.

Lynchburg Belt.—PETER J. OTEY, President, of Lynchburg, Va., has sent us the following:

The surveys have been made for this road, which is to be a belt line transfer around the city of Lynchburg. The projected length of the road is about 7 miles. Maximum grade is 80 ft. per mile and the maximum curve is 10°. Two miles right of way has been obtained and $25,000 local aid has been subscribed. It is expected that a part of the track will be laid within 90 days. The company was incorporated in March, 1881. R. TAYLOR GLEAVES is Chief Engineer.

Macon & Birmingham.—This company has organized in Alabama to build a railway from Macon, Ga., to Birmingham, Ala. The following are the officers: President, F. S. JOHNSON; Vice-President, W. A. DOODY; Secretary and Treasurer, N. M. HODGKINS.

Zanesville, Beverly & Parkersburg.—A surveying corps in charge of W. P. ROBINSON and EDWARD BARRINGTON are making surveys near Parkersburg, W. Va., in order to pass Belpre hill without a tunnel. The line is part of the projected "Black Diamond" system.

Virginia & Kentucky.—The following has been sent us by DAVID S. PIERCE, of Wytheville, Va., President:

This line is to run from Danville, Va., via Stuart, Patrick county, Va., Wytheville and Tazewell Court House to the Kentucky State line, a distance of 200 miles. The route is through the mountains of southwestern Virginia but by following the courses of the rivers easy grades and curves can be obtained. There will be six tunnels averaging about 1,000 ft. each. The line passes through the coal and iron belt of Virginia and will have a large business in the transportation of minerals. Most of the right-of-way has been obtained and local aid will be easily voted by the towns along the route. The survey will commence about May 1, and it is expected to let contracts by July 1. Tracklaying will probably begin about Jan. 1, 1890, and the road be opened for traffic by Jan. 1, 1891. J. C. WRENSHALL, of Danville, Va., is Chief Engineer.

THE NORTHWEST.—Existing Roads.

Chicago & Northwestern.—It is reported that surveyors are at work on a line from Redfield, Dak., to the Black Hills and construction will begin as soon as the Sioux reservation is opened.

Duluth, Red Wing & Southern.—Tracklaying has begun on the extension to Zumbrota, Minn., and the line will be completed to that place within 10 days.

Illinois Central.—It is stated that work will begin in a short time on the branch from Duquoin to Hornville, Ill.

Union Pacific.—By a recent trackage arrangement with the Chicago, St. Paul, Minneapolis & Omaha company Union Pacific trains are now run to Sioux City over the C., St. P., M. & O. tracks.

Projects and Surveys.

Belleville & St. Louis.—Incorporated in Illinois to build a line of railway from Belleville to East St. Louis, a distance of about 13 miles. Among the incorporators are: EDWARD L. THOMAS and JOHN T. TAYLOR, of Belleville, JOHN S. HILL, of East St. Louis, and B. S. ADAMS, of St. Louis.

Alton Terminal.—Incorporated by DELOS R. HAYNES of St. Louis; P. A. GARRIOT, of Springfield, Ill., and F. E. FISHER, of Jerseyville, Ill., to build a railway from a point on the Mississippi river in the northwestern part of Madison county via Alton to Venice in the same county, a distance of about 20 miles.

Polk & Forty-ninth Street Junction.—Incorporated in Illinois to build a railway from the junction of the Grand Trunk and the Chicago & Western Indiana R. R. north to Polk St. in the city of Chicago. Among the incorporators are W. J. SPICER, A. B. ATWATER, and HERBERT ROBERTS, of Detroit, Mich.

Pacific Short Line.—Proposals will be received for grading and bridging 100 miles from Sioux City, Ia., west, until April 15. Bids should be addressed to DONALD MCLEAN, General Manager, Wyoming & Pacific Improvement Co., Chamber of Commerce Building, Sioux City Ia., where profiles and specifications can be seen.

THE SOUTHWEST. Existing Roads.

Cape Girardeau & Southwestern.—The 23 mile extension of this road to Hunter on the Current River branch of the Kansas City, Fort Scott and Memphis system has been completed and will be put in operation immediately.

Fort Worth & Rio Grande.—It is rumored that this company has let contracts for building the first 60 miles of the extension from Granbury.

Louisville, New Orleans & Texas.—It is stated that this company will build a transfer at Helena, Ark., if the citizens will give them right of way over certain streets and $25,000, besides sufficient ground for a freight and passenger depot and switching yards.

St. Louis & San Francisco.—The annual report of this company for 1888 shows as follows:

	1887.	1888.
Gross Earnings	$6,889,793	$6,311,144
Expenses	3,355,615	2,668,099
Net Earnings	3,534,178	3,643,045

Chicago, Rock Island & Pacific.—It is announced that the southwestern extension is to be pushed on to Kingfisher, Ind. Ter., about 70 miles south of the Kansas State line, and ultimately to Fort Reno. The opening of the Oklahoma Indian Reservation is the cause of this work.

Baton Rouge, Ponchatoula & Mobile.—The president of this company, C. S. BURT, of Baton Rouge, La., writes us as follows:

This company was chartered May 9, 1889, and is empowered to build a railway from the Mississippi river east to the Mississippi State line, about 100 miles. The proposed line would run through a level country and secure a local traffic in lumber, cotton, etc. Five miles from Burtville on the L. N. O. & T. R. R. to Woodstock Mills, are now in operation as a lumber road, and no more will be built for some time. When the whole line is completed it will do a general traffic business.

Denison & Washita Valley.—The company has made arrangements to increase its capital stock and to build 125 miles of railway before Jan. 1, 1890. The amended charter permits the company to construct a line to Oklahoma territory, and this will be one of the first works undertaken by the company. EDWARD CHADICK, of Denison, Tex., is General Manager.

Atchison, Topeka & Santa Fé.—The stock of this company has had another shrinkage and has sold as low as 30½ during the past week. The report that the control of the company is rapidly coming into GOULD hands is being repeated, and finds many believers. The annual meeting will be held at Topeka May 9 and Messrs. Kidder, Peabody & Co., the Boston bankers, are already calling for proxies which they propose to use to bring about a change in the company's management. Talk of a receivership is heard of course, but it is denied by all those connected with the company. Many who have been strongest in their attacks on the company now claim that the stock has gone below its real value and that a recovery is in order.

Projects and Surveys.

Kingston & Polo Short Line.—S. C. ROGERS, of Kingston, Mo., writes as follows:

The preliminary survey has been made for this road, which is to run from Kingston to Polo, 7 miles. The work is light, and there are only two small bridges. The principal business of the road will be in local passenger and freight traffic. It is expected that contracts for construction will be let about September, 1889. C. W. M. LOVE, is President, and JOHNSON BOYDE is Chief Engineer.

Central Arkansas.—This company recently incorporated in Arkansas proposes to construct and equip the line formerly known as the Pine Bluff, Monroe & New Orleans R. R., and to build a line from the present ter

minus of the Pine Bluff & Swan Lake R. R. to Little Rock with a branch to the Mississippi river. Among the incorporators are A. C. BARSTOW, W. A. BRADFORD, and J. R. CAMPBELL.

Reed Springs & Kansas City.—Incorporated in Missouri to build a railway from the Hannibal & St. Joseph R. R. depot at Liberty, Mo., to Reed Springs, a distance of 4 miles. It is the company's intention to ultimately build the line to Kansas City.

Kansas City & Quindaro. — This company has been chartered in Kansas to build a railway from Kansas City, Kan. to Quindaro, Kan., a distance of about 20 miles. This company is the same as the one incorporated in Missouri under the name of the Second Street Belt Line to build a line from Second St. and Broadway to the mouth of the Blue creek and thence to the State line. Among the directors are, E. L. MARTIN, G. W. MCCLELLAND and V. T. LANE, all of Kansas City, Kan.

Shreveport & Texarkana. — Incorporated in Louisiana to build a line of railway from Shreveport to the Arkansas State line.

Waco & Brazos City.—It is stated that a project is on foot to build a line of railway from Waco, Tex. along the east bank of the Brazos river to Richmond, and thence down the west bank to Brazos City at the mouth, an estimated distance of 225 miles.

ROCKY MT. AND PAC.—Existing Roads.

Union Pacific.—At a recent meeting of the directors of the Utah Central Ry. it was voted to extend the line from Milford to a point at or near Pioche, Nev., about 100 miles; also to construct a branch from Juab to the Castle Valley coal fields.—The Oregon Short Line Company has filed amended articles of incorporation empowering it to build, lease, purchase, consolidate or acquire otherwise railways running from Pocatello west to the Pacific coast; from McCammon south to Ogden or Salt Lake City, and from some point on its line in Idaho or Wyoming in a general easterly direction through those territories.

Northern Pacific.—It is stated that the extension from Wallace to Mullan up the south fork of the Coeur d'Alene river has been completed. A line is contemplated to run from Coeur d'Alene City via Mullan to a point west of Missoula.

Southern Pacific.— This company intends to increase its capital stock from $100,000,000 to $150,000,000. This addition of $50,000,000 is to enable the company to consolidate a larger mileage of roads now controlled in different ways.

Seattle, Lake Shore & Eastern.—It is stated that work on the extension of this road northward to the British Columbia boundary will begin soon.

Spokane Falls & Northern.— The following information has been sent us by D. C. CORBIN, of Spokane Falls, W. Ter.:

This road is to run from Spokane Falls via Wild Rose Prairie, Columbia and Colville to Little Dalles, a distance of 175 miles. The locating surveys for the first 80 miles are nearly finished, and the contract for construction has been let. The work is generally heavy; maximum grade 1 per cent, and maximum curve 16°. The principal business will be in lumber, hay, grain, coal and ores. Right of way has been nearly all obtained. $400,000 has been subscribed by the citizens of Spokane Falls. It is expected that tracklaying will begin about May 15, and the first 80 miles will be open for traffic about Oct. 1, 1889. J. K. SHERWOOD of New York City is President and Mayor ALFRED C. CHAPIN of Brooklyn is Secretary and Treasurer.

Oregonian.—The affairs of this company have been wound up by the order of the Supreme Court of Scotland and DAVID MILES, of Dundee, Scotland, has been appointed official liquidator. It is stated that neither the stockholders nor bondholders will attempt to reorganize the company and that as soon as possible the property will be sold. That this will be an easy thing is not probable, since the affairs of the company are in such a condition that neither the indebtedness nor the priority of the liens are known, and until these are ascertained the road is not a desirable purchase.

Projects and Surveys.

Denver, Colorado Canyon & Pacific.—A company has been incorporated in Colorado to build a line of railway through the Grand Canyon of the the Colorado River, commencing at a point near Grand Junction and terminating at some point on the Pacific coast, probably San Diego. The length of the road would be about 1,050 miles and of this distance 200 miles would be through the canyon. Among the incorporators are H. B. CHAMBERLAIN, J. C. MONTGOMERY, B. B. LAWRENCE, and others. The offices of the company are to be at Denver. Work on the survey began on March 28.

Spokane, Post Falls & Eastern.—This company has been organized in Washington Territory with F. POST, President, GEO. A. MANNING, Secretary, and W. D. PALMER, Treasurer, to build a railway from Spokane Falls via Post Falls, Cœur d'Alene and Pend d'Oreille lakes east to a connection with the St. Paul, Minneapolis & Manitoba system.

Port Townsend & Hadlock.—It is stated that a project to build a narrow gauge road between Port Townsend and Port Hadlock, W. Ter., is under consideration.

Umatilla Central.—It is announced that a plan is on foot to build a railway from Umatilla, Ore., through the Horse Heaven country to a point near Prosser, about 100 miles. JOHN T. FLYNN, of Portland, Ore., is interested.

FOREIGN.

Monterey & Mexican Gulf.—We have received the following information from one of the officers of this Mexican company:

The Monterey & Mexican Gulf is now laying track at the rate of a mile a day from Monterey towards Cadereyta and Montemorelos. Rails, ties and material sufficient to complete the first 60 miles are on the ground, and the Mexican Government has already accepted the first 10 kilometres of the road. The road is to run from Monterey, the capital of Nuevo Leon, to Tampico on the Gulf of Mexico, a distance of 400 miles. It is being built entirely by American capital, and the general offices of the company are at 40 and 42 Wall St., New York City. The concession granted to the road by the Mexican Government is one of the most valuable ever granted by that Government. The road will open up an entirely new country and one of the most productive in Mexico. Cotton, corn, tobacco, sugar, rice, and all tropical and semi-tropical fruits are raised along the route, and it passes through large forests of oak, rosewood, mahogany and logwood. The country is thickly populated, and the road passes through several large and growing cities. About 2,000 men are now at work on the line.

Mexican Pacific.— Lieut. FREDERICK SCHWATKA, the celebrated Arctic explorer, is at work on the surveys for this road running from Deming, New Mexico, and Las Palomas to Guaymas, a distance of about 1,200 miles. The route is through the timber belt and mining camps of the Sierra Madre.

Interoceanic.—It is stated that the line between the City of Mexico and Perote is nearly completed, and will be opened for traffic soon.

RAPID TRANSIT.

Street Railways. — ***Syracuse, N. Y.***— The People's Railway Co. will have its southern line in operation soon, and its northern line by June.

Rochester, N. Y.—The Rochester City & Brighton Ry. Co. will extend its tracks to the village of Brighton.

Roanoke, Va.—The Roanoke & Vinton Street Ry. Co. has purchased its rails. Dummy engines may be used, but ultimately an electric system will be adopted. President, C. O'LEARY; Secretary, W. BUDWELL; General Manager, J. F. CHRISTIAN: Engineers, DUNSTON & WINGATE.

Mt. Sterling, Ky.—A street railway is projected. H. C. MCKEE or J. W. HADDEN can give particulars.

Columbus, Ga.—The Columbus Street Railway Co. will extend its line about 1 mile on Hamilton Ave.; the work is to be completed by May.

Montgomery, Ala. — A street railway franchise has been granted to F. M. BILLING, W. F. JOSEPH, and W. F. VANDIVER.

Mexico, Mo. — A street railway line is projected, and may be built this season.

Nebraska City, Neb.—The Nebraska City Street Ry Co. has increased its capital stock, and will extend its line to the stock yards.

Portland, Ore.—The Metropolitan Railway Co. has applied for a 30-year franchise for a street railway; the road to be in operation by July, 1890.

Cable Railways.—***Denver, Col.***—The name of the contractors for the lines of the Denver City Cable Ry. Co. should be Christie & Lowe, and not Christie & O'Day, as given on p. 247.

Portland, Ore.—The Portland Cable Ry. Co. has all its stock subscribed for and will begin construction at once.

Newark, N. J.—The Rapid Transit Street Ry. Co. has been organized by ELIAS S. WARD, Dr. LESLIE D. WARD, JOHN F. DRYDEN and others, and will apply for power to build 5 miles of cable road. Capital stock, $10,000.

Electric Railways.—***Cincinnati, O.***—The Cincinnati Street Ry. Co. is equipping 3 miles of double track on the Coleraine Ave. line with the Thomson-Houston system. There will be 8 cars. The road will be in operation by May.

Nashville, Tenn.—The South Nashville Street Ry. Co. has applied for power to operate its line by electricity.

Summerville, S. C.—An electric railway is to be built. The Thomson-Houston system will be adopted. Major GEO. B. EDWARDS, President of the Charleston Electric Light & Power Co., is interested.

St. Joseph, Mo.—The People's Electric Street Ry. Co. has been organized by JAMES B. NEWCOMBE and S. S. PALMER, of New York, J. A. CORBY and T. F. VANNATTA, of St. Joseph, and others, to build an electric railway.

Topeka, Kan.—The Rapid Transit Ry. Co. has completed its lines. There are 16½ miles of track, which is said to be the greatest length of any existing electric railway. The line is operated by the Thomson-Houston system. There are two engines of 1,200 H. P., 9 dynamos and 43 cars. A speed of 15 miles can be attained, but the limit is 8 miles in the city.

Denver, Col.—An electric railway is to be built to University Park. Collins & Shackelford are interested.

Sehome, Wash. Ter.—The Bellingham Bay Street Ry. Co. will build an electric line. D. K. HUNTOON is one of the promoters.

CONTRACTING.

Dredging. — The following proposals were opened March 27 by Gen. WM. F. SMITH, U. S. Engineer Office, Wilmington, Del.:—***In Corsica creek, Md.***: Baltimore Dredging Co., Baltimore, Md., 12¾ cts. per cu. yd. in scows. National Dredging Co., Wilmington, Del., 12.9 cts. Chester T. Caler, Norfolk, Va., 13¼ cts. Frank C. Somers, Camden, N. J., 13½ cts. Atlas Dredging Co., Wilmington, Del., 14 cts. Geo. C. Fobes, Baltimore, Md., 14 cts. American Dredging Co., Philadelphia, Pa., 14½ cts.

In Fairlee creek, Md.: Chester T. Caler, 23 cts. per cu. yd. in scows. Atlas Dredging Co., 24 cts. American Dredging Co., 25 cts. Baltimore Dredging Co., 26 cts. F. C. Somers, 30 cts.

In Broad creek, Del.: F. C. Somers, 20 cts. per cu. yd. for once handling, 30 cts. per cu. yd. for rehandling. Chester T. Caler, 22 cts., 30 cts. Baltimore Dredging Co., 24 cts., 33 cts. American Dredging Co., 30 cts. per cu. yd. in place.

Filling.—***Boston, Mass.*** The following proposals for filling a portion of the South Boston flats were opened March 28 by the Harbor and Land Commissioners: E. B. Whittier, Boston, 14½ cts. per cu. yd. N. B. Crockett, Boston, 14½ cts. American Rapid Dredging Co., Boston, 19 cts. New England Dredging Co., Boston, 25 cts. Boynton Bros., Boston, 33 cts. FRANK W. HODGDON is Assistant Engineer to the Commissioners.

Greycourt, N. J.— Ross & Sanford, of Jersey City, have the contract for the big fill across the meadows for the new Orange County Railway, a part of the New Jersey Central System. The fill is 2,000 ft. long, requiring 80,000 cu. yds. of earth.

Pipe and Castings.—At Pittsburg, Pa., the Board of Awards awarded the contract for furnishing 2,100 tons of 30 in. cast-iron water pipe to the Addyston Pipe & Steel Co., of Cincinnati, at $24.25 per ton. The same firm got the contract for 30-in. special castings at $42 per ton. William Yagle & Co., of Pittsburg, secured the contract for special castings on other sizes at $43.45 per ton, and the National Foundry & Pipe Works, of Scottdale, for 1,900 tons of 4, 6, 8, 12, and 16-in. pipe, at from $22.50 to $23.50 per ton.

Sewers.—***Kansas City, Mo.*** — The City Council has awarded contracts as follows: For Sewers in the Sixth District, Howard Williams, $15,497.85; Ferry St. sewer, Howard Williams, $6,000; Splitlog creek sewer, T. Enright, $22,800. Mr. Williams' bid on the Sixth St. sewer was 65 cts. for 10-in. pipe, 80 cts. for 12-in. pipe, $1.50 for 21-in. pipe, $3.25 for 2¼-ft. brick sewer, $3.90 for 2¾-ft. brick sewer, $3.70 for 3¼-ft. brick sewer, $4 for 3¾-ft. brick sewer, $5 for 4-ft. sewer, $40 each for manholes, $80 for catch-basin. The contract price for the Terry St. sewer was $6.30 for 4-ft. brick sewer, $7 for 4-ft. iron pipe, $50 each for manholes, $80 each for catch-basins. Mr. Enright's price for the Splitlog sewer was $6.12 for 4½-ft. brick sewer, $9.20 for 5¾-ft. brick sewer, $10.20 for 6½-ft. sewer, $45 each for manholes, $75 for catch-basins.

Castings. — The Water Board, Boston, Mass., has awarded a contract for 400,000 lbs. iron and 250,000 lbs. service boxes to S. B. Locke & Co., at 2 cts. per lb.; total, $13,000. A contract has also been awarded to the Boston Standard Metal Co. for 100,000 lbs. brass castings at 12¾ cts. per lb., and 20,000 lbs. of composition castings at 13¾ and 14¾ cts. per lb.; total, $4,075.

Railway.—The following contracts have been awarded by Chief Engineer E. T. D. MYERS, Richmond, Va., for work on 8 miles of railway, connecting the Richmond, Fredericksburg & Potomac, and the Richmond & Petersburg roads near Richmond, Va., including a high bridge across the rapids of James river. Grading and masonry, A. W. Harman & Co.; bridge masonry, Mason, Hoge & Thrasher; bridge superstructure, Edge Moor Iron Co., Wilmington, Del.

Granite Blocks.—The following proposals for 8,000,000 granite paving blocks were opened March 29 by JOHN P. ADAMS, Commissioner of City Works, Brooklyn, N. Y.: Charles Hart—500,000 blocks at $74.49 per 1,000; for 250,000 at $75.49; for 6,000,000 at $93.69. Booth Bros. & Hurricane Isle Granite Co., New York: 500,000 blocks at $82.49 per 1,000; 1,500,000 at $84.89; 900,000 at $87.49; 1,100,000 blocks at $87.40; 3,000,000 at $92.49. Charles Gindeb, New York: 300,000 at $70; 200,000 at $80; 300,000 at $85. New York & Maine Granite Paving Block Co., New York: 100,000 at $76.40; 100,000 at $77.40; 100,000 at $79.40; 100,000 at $81.40; 100,000 at $82.40; 500,000 at $84.40; 800,000 at $87.40; 1,000,000 at $97.40. Lockport Granite Co., Lockport, Mass.: 100,000 at $78.30; 100,000 at $80.44; 500,000 at $85.20. Hogg & Scribner, New York: 300,000 at $79. F. H. Smith, New York: 300,000 at $78.89.

Dams and Shore Protections.—The following proposals were received March 20 by Major A. MACKENZIE, U. S. Engineer Office, Rock Island, Ill.:—***Near Fort Madison, Ia.***: Patterson Bros., Keokuk, Ia.: $1.20 per cu. yd. for 14,000 cu. yds. of stone in place, 40 cts. per cu. yd. for 14,000 cu. yds. of brush in place, $22,400 total. A. J. Whitney, Rock Island, Ill.: $1.19, 50 cts., $23,660. H. S. Brown, Quincy, Ill.: $1.15, 65 cts., $25,200. Geo. H. Schafer, $1.14, 70 cts., $25,760. Conrad Rimbeck, Keokuk, Ia.: $1.25, 70 cts., $27,300. Geo. Lamont, Rock Island, Ill.: $1.50, 55 cts. $28,700. Albert Kirchner, Fountain City, Wis.: $1.35, 70 cts., $28,700. Jacob Richtman, Fountain City, Wis.: $1.44, 63 cts., $28,980. B. Landry & Sons, Fort Madison, Ia.: $1.45, 75 cts., $30,800. S. S. Truax, Hastings, Minn.: $1.25, $31,500. Fruin-Bambrick Construction Co., St. Louis, Mo.,

$1.45, 65 cts., $32,200. Chas. H. Appleton, Quincy, Ill: $1.95, 85 cts., $39,200.

Near Keithsburg, Ill.—A. J. Whitney: $1.20 per cu. yd. for 20,000 cu. yds. of stone in place, 40 cts. per cu. yd. for 20,000 cu. yds. of brush in place, $32,000 total. Coleman Bros. Davenport, Ia.: $1.04, 40 cts., $38,000. Peter McGee, St Charles, Mo.: $1.38½, 64½ cts., $40,600. Geo. H. Schafer: $1.40, 70 cts., $42,000. Conrad Eimbeck: $1.45, 68 cts., $42,900. Geo. Lamont: $1.60, 55 cts., $43,000. Jacob Richtman: $1.53, 63 cts., $43,300 S. J. Truax: $1.40, 70 cts., $43,800. A. Kirchner: $1.50, 70 cts., $44,000. Fruin-Bambrick Construction Co., $1.50, 85 cts., $47,000. H. S. Brown: $1.60, 75 cts., $47,000. Fisher, Koehler & Co., Muscatine, Ia.: $1.75, 70 cts., $49,000. Patterson Bros.: $1.75, 85 cts., $52,000. J. Loftus and C. A. Came ron, Burlington, Ia.: $1.54, $1.24 $54,800.

Between Fairport and Muscatine, Ia.: A. J Whitney: $1.15 per cu. yd. for 20,000 cu. yds. of stone in place, 50 cts. per cu. yd, for 20,000 cu, yds. of brush in place, $31,000 total. Patterson Bros.: $1.20, 40 cts., $32,000. Coleman Bros.: $1.25, 40 cts. $33,000. Thomas G. Isherwood, Le Claire, Ia.: $1.23, 55 cts., $34,000. A. Kirchner: $1.20, 57 cts $35,400. Peter McGee: $1.19½, 60 cts., $35,900. Dodge, Halbert & Co., Davenport, Ia.: $1.19½, 67½ cts., $37,400. S. J. Truax: $1.24, 65 cts., $37,800. Geo. Lamont: $1.40 55 cts., $39,000. Fruin Bambrick Construction Co.: $1.35, 70 cts., $39,000, Conrad Eimbeck: $1.35, 65 cts., $40,000, J. Richtman: $1.44, 63 cts., $41,400. Geo. H. Schafer: $1.40 70 cts., $42,000. H. S. Brown: $1.10, $1, $42,000. C. H. Appleton, Quincy, Ill.: $1.65, 85 cts., $50,000.

Between Read's Landing, Minn., and Fountain City, Wis.: A. J. Whitney: $1.30 per cu. yd. for 22,000 cu. yds. of stone in place, 50 cts. per cu. yd. for 18,000 cu. yds. of brush in place, $37,600. A. Kirchner: $1.24, 60 cts., $38,080. J. Richtman: $1.26, 63 cts., $39,000. S. J. Truax: $1.49, 50 cts., $41,780. Clarence Jellison, Wabasha, Minn.: $1.20, 95 cts., $43,500. Patterson Bros.: $1.55, 85 cts., $49,400. C. H. Appleton: $1.65, 85 cts, $51,000.

Tunnel.—The following proposals for the construction of a tunnel under the Calumet river at 95th St. were opened March 26 by A. V. POWELL, Superintendent of Public Works, Hyde Park, Ill. The tunnel will be 250 ft. long, with a shaft at each end about 50 ft. deep; tunnel and shafts will be 6 ft. diameter in the clear. Osborne & Barber, Chicago: $13 per ft, for 250 ft. of tunnel, $19.50 per ft. for 104 ft. of shaft, $5,200 total. Wm, A. Lydon, Chicago: $20, $28, $7,800. D. & J. Hardin, Chicago: $8,500, and $10 per yd. for rock, P. M. Conboy, South Chicago: $24, $30, $9,000, and $7 per cu. yd. for extra masonry. DeCreet & Eckerman, Chicago: $24, $31, $9,100. Roger Power, South Chicago: $25, $30, $9,500. W. P. Gerrity, Chicago: $11,300. J. S. Casement, Cleveland, O.: $30, $100, $17,500. The contract was awarded to Osborne & Barker, of Chicago.

PROPOSALS OPEN.

Sewer.—Building a 4-ft. sewer; plans and specifications on file. A. P. CARPENTER, Secretary, Sewer Commissioners, Central Falls, R. I. April 8.

Street Work.—Grading and cobl lestone paving. JOHN P. ADAMS, Commissioner of City Works, Brooklyn, N. Y. April 8.

Sewers.—At Fort Sheridan, Ill. CROSBY P. MILLER, Asst. Quartermaster, U. S. A., Highland Park, Ill. April 9.

Hydrants.—Furnishing 20 single outlet hydrants, GEO. REYER, Superintendent of Water-Works, Nashville, Tenn. April 9.

Broken Stone.—About 2,400 cu. yds. of 2½-in. broken granite, and 1,600 cu. yds. of granite screenings. THE DEPARTMENT OF PUBLIC WORKS, 31 Chambers St., New York City. April 10.

Sand.—During the year. JOHN P. ADAMS, Commissioner of City Works, Brooklyn, N. Y. April 11.

Street Work and Pipes.—Granite block paving on concrete foundation; cast-iron pipes and castings; pipe laying, etc. THE DEPARTMENT OF PUBLIC WORKS, 31 Chambers St., New York City, April 12.

Railway.—Grading and bridging about 100 miles of the Nebraska & Western Ry. from Sioux City, west. L. H. CLARKE, Chief Engineer. DONALD MCLEAN, General Manager, Wyoming Pacific Improvement Co., Sioux City, Ia., April 15.

Stone.—For locks. Major D. W. LOCKWOOD, U. S. Engineer Office, Cincinnati, O. April 19.

Tunnel.—Drain tunnel; 7 ft. high, 4 ft. wide at top, 5 ft. at sill of inside timbers; 4,500 ft. Price per foot. CHAS. T. STEVENSON, Secretary, Alliance Mining Co., Box 624, Salt Lake City, Utah. April 27.

Tunnel.—Under Lake Michigan, for the water-works; 5,000 ft. of 5 and 6 ft. brick tunnel, with shore and lake shafts, crib, etc. EDGAR SANDERS, Commissioner of Public Works, Lake View, Ill. April 30.

Iron Bridges.—Five bridges. JOHN BUCHANAN, Clerk of the County Court, Hallettsville, Lavaca County, Tex. May 13.

Reservoir.—For East Buffalo water-works; area, 722 acres; capacity, 125,000,000 galls. THE WATER COMMISSIONERS, City Hall, Buffalo, N. Y. May 21.

MANUFACTURING AND TECHNICAL.

Blue Print Fabric. — Williams & Brown, of Philadelphia, have placed on the market a linen fabric called "Linaura" which is especially designed for blue prints and is claimed to be indestructible. The process of printing is the same as with ordinary blue-print paper.

Electric Heaters.—The Burton Electric Co., of Richmond, Va., will make a test of its heater for railway cars.

The Bucyrus Steam Shovel & Dredge Co. has been incorporated at Bucyrus, O., with a capital stock of $150,000.

The Hoyt Frog & Crossing Co. will erect a factory at Joliet, Ill.

Paving Materials are wanted at Alexandria, Va.; address Hon. E. L. DORMHAM, mayor.

Roller Bearings. — The Chicago Roller-Bearing Car Truck Co. has been organized at Chicago, Ill., by W. J. COOKE, L. C. BURGESS, and W. M. BALDWIN. Capital stock, $50,000.

Stone.—The Brazos Stone Co., capital stock of $100,000, has been organized by J. F. PRINCE, of Fort Worth, Tex., W. B. BROOKS, of Dallas, and others.

Fencing.—The Western Fence Co., of Chicago, has finished the fencing on the Chicago, Kansas & Nebraska; it consists of the Kelly barb wire with cedar posts.

Filters.—DEUTCH VS. HYATT, case of interference of patents, was heard by the examiners-in-chief on appeal, and the decision of the Examiner in charge of Interferences in affirmed and the question of priority of invention is decided in favor of JOHN W. HYATT.

The Bucyrus Foundry & Mfg. Co., of Bucyrus, O., builders of steam excavating machinery, report busines good. They are building a number of large steam dredges, one of which it is said will be the largest and finest and have the largest capacity of any dredge build in this country.

The Brown Hoisting & Conveying Machine Co. (CORRECTION.)—In the advertising controversy between Howard Carson, of Boston, and J. Ryan, of Watertown, N. Y., over sewer excavating machinery, the advertisements of the last two parties were inadvertently placed on the same page with that of the Brown Hoisting & Conveying Machine Co., which we have been informed brought the patents of the latter into question also. Mr. Carson has written the Brown Hoisting & Conveying Machine Co., disclaiming any purpose on his part in the matter. As there is no question at all at issue between him and that company, we have been requested to correct any misapprehension that may have arisen in the minds of intending purchasers.

Street Sprinklers.—The Department of Public Works, Pittsburg, Pa., has arranged for a number of street sweepers and sprinklers. The traction railway companies will also put sprinkling carts along the line of their routes, and will work in unison with the Department of Public Works. Bids have been advertised for the construction of sweepers and sprinklers, and they will be put on without delay.

Car Notes.—The Ohio Falls Car Co., of Jeffersonville, Ky., is building passenger cars for the Louisville, St Louis & Texas, and freight and passenger cars for the Kentucky Midland.

The Indianapolis Car Works, of Indianapolis, Ind., are turning out 16 freight cars per day for the Chesapeake & Ohio. They are built to the plans of Mr. W. GARSTANG, Superintendent of Rolling Stock of the road.

The Missouri Car & Foundry Co. is building 500 box cars for the Louisville & Nashville.

The Barney & Smith Mfg. Co., of Dayton, O., has recently shipped 10 baggage cars to the Mexican Central.

The Huntington Mfg. Co., of Huntington, Pa., is building 250 iron freight cars for the Western & Atlantic.

The Pullman Palace Car Co., of Pullman, Ill., has an order for 50 passenger cars and 5 combination smoking and baggage cars, for the Atlantic City division of the Philadelphia & Reading.

The Gadsden Car Works of Gadsden, Ala., have an order on hand for 700 cars.

The Burton Stock Car Co., of Wichita, Kan., is building 200 cars at its Wichita works.

The Wagner Palace Car Co., has turned out the first of the four new-style "boudoir" vestibuled cars for the New York and Chicago limited train on the New York Central.

The Northern Pacific R. R. Co. is fitting the vestibule arrangement to its first class cars, dining cars and sleepers.

Aluminum.—The United States Aluminum Co., of East St. Louis, capital $1,000,000, has been incorporated for the manufacture of aluminum and its alloys, and for improving, strengthening, toughening, and benefiting iron, steel, copper, and other metallic substances. ROBERT M. FOLTERS, JOHN R. TRUESDALE, and GEORGE HACKSTAFF.

Rails.—The Garrison Co., of St. Louis, Mo., has the contract for the steel rails for the Duquoin & Hornville road.

Locomotives.—The Schenectady Locomotive Works, of Schenectady, N. Y., are building the engines for the Fairhaven & Southern road, in Washington Territory.

The Pittsburg Locomotive Works, of Pittsburg, N. Y., have shipped one engine of an order for 7 to the St. Louis, Vandalia & Terre Haute. According to report this engine recently brought into Indianapolis 41 loaded cars, being the heaviest train ever hauled over this road by one locomotive. Mr. PRESCOTT, Superintendent of Motive Power, is said to be making a series of tests with these new heavy freight engines and comparing their service with those of a lighter pattern. Thus far the tests have been highly favorable to the heavier engines.

The Rhode Island Locomotive Works, of Providence, R. I., have completed an order of 10 engines for the Savannah, Florida & Western, 5 for the Charleston & Savannah and 7 for the Brunswick & Western.

The Pennsylvania Railroad will build 15 class A anthracite burning engines at its shops at Altoona, Pa. For the Pittsburg, Cincinnati & St. Louis line 10 passenger engines and 35 freight engines have been ordered.

The Rochester & Glen Haven Ry. will order 2 locomotives and 6 or 8 passenger cars. C. W. MILLS, Rochester, N. Y., is the Master Mechanic.

Heavy Locomotives.—Among the heaviest locomotives built are those recently put on the mountain division of the Philadelphia & Reading R. R. The actual weight in working order is 155,040 lbs., with 138,340 lbs. on the drivers. They have a tractive force of 271 lbs per pound average pressure in the cylinder. The cylinders are 22 x 28; driving wheels, 50 ins. diameter; boiler, 6 ft. in diameter and 13 ft. 6 ins. long over tube sheets. The tubes are 270 in number and 2 1-4 ins. in diameter. The fire-box is over 11 ft. long inside by 42 ins. wide, and is placed above the frames, but not above the wheels. The heating surface in the fire-box is 185 sq ft. and the total heating surface 2,345 sq. ft. The engine is designed to burn anthracite, but not, like the Wootten engines, buckwheat or refuse coal.

Tippett & Wood will continue to be the name of this firm, though the interest of the late JACOB TIPPETT has been sold to J. WHIT. WOOD, the surviving partner, who is now sole proprietor. The firm manufactures stand-pipes, boilers, well-casing and plate-iron work of all kinds for water-works. The works are at Phillipsburg, N. J.

Pump Governor.—The Collum Steam Pump Governor Co. has been organized at Denver, Col., by W. R. ROBINSON, B. DALLEN, and others.

Signals.—The Riggs Electric Traveling Danger Signal Co. has been incorporated by JOSEPH W. RIGGS, St. Paul, Minn.; DARWIN H. KINGSLEY and J. A. G. RICHARDSON, of Minneapolis. Capital stock, $3,000,000.

The Pacific Construction Co. has been incorporated at Tacoma, Wash. Ty., by GEO. BROWNE, PERCY DICKINSON, and CHARLES KING. Capital stock, $25,000.

Car-Wheel Works.—ROBERT E. MASTERS and BENJAMIN & BRO., of Jefferson, Tex., are interested with northern capitalists in a project to establish car-wheel works.

New Rolling Plant.—Mr. Jos. GEST, of Pittsburg, Pa., has invented and patented a method of rolling iron and steel rails into merchant bar iron, structural iron, etc., and a plant has been put into successful operation in Pittsburg by Lean & Blair, contractors and engineers. Another plant is to be put into operation at the Tidewater Steel Works, Chester, Pa. The Structural Steel & Iron Co. has been organized to control this system. It is claimed that this method of rolling will do the same work in three passes that under the ordinary processes requires 11 and 12 passes.

Tension Carriage. — The Walker Mfg. Co., of Cleveland, O., manufactures an improved form of tension carriage for cable railways, for maintaining the cable at proper tension. These carriages are in use on the Fifth St., Twelfth St., and Eighteenth St. cable roads and the Union Railway, of Kansas City, Mo., the St. Louis Cable & Western Railway, St. Louis, Mo., and the Butte City Street Railway, Butte City, Mont.

Iron Works.—The West Superior Iron & Steel Co. has been organized in New York to establish extensive works at West Superior, Minn. There will be 7 blast furnaces with a daily capacity of 200 tons, extensive docks, rolling mills, etc. Mr. W. F. MATTES, formerly with the Lackawanna Coal & Iron Co., is the General Manager.

The Totten & Hogg Iron & Steel Co. has been organized at Pittsburg, Pa., by ROBERT C. TOTTEN, NATHANIEL B. HOGG, and others. Capital stock, $150,000.

The Norway Steel & Iron Works, of South Boston, Mass., erected at a cost of $1,250,000, are said to have been sold for $125,000.

W. D. Wood & Co., of McKeesport, Pa., propose to erect a mill for the manufacture of steel plates.

The affairs of the Reading Iron Works, of Reading, Pa., which failed recently, are not yet settled.

BRIDGES AND CANALS.

Bridge Notes.—*Bangor, Me.*—The Maine Central R.R. Co. has replaced the old wooden draw over the Kenduskeag with an iron draw. The wooden span will be replaced with iron during the summer.

Rochester, N. Y.—The contract for the pile and trestle work along the line of the Lincoln Park & Charlotte Railway has been awarded to Col. John E. McIntyre, of Buffalo. It calls for the building of 2½ miles of trestle-work: 1,500,000 ft. of timber will be required and the orders for it have already been placed. Work is in progress on the abutments of the bridges.

Buffalo, N. Y.—The contract for bridge repairs has been let to John Needham. A new iron bridge is to be built at Seneca St. and Abbott's Corners road.

Binghamton, N. Y.—A committee has been appointed to call for plans and estimates of the bridge over the Chenango river.

Amsterdam, N. Y.—A new iron bridge is to be built across the Chuctanunda creek, in the 5th Ward.

Defiance, O.—Bonds for $50,000 are to be issued for a bridge across the Maumee river.

Pittsburg, Pa.—The City Bridge Co. will build a bridge to Allegheny; a cable road will be laid over it. GEO. E. WILSON, and JOSHUA RHODES are interested.

Lancaster, Pa.—The Willow Street Turnpike Co. will build an iron bridge, 125 ft. long and 18 ft. wide, to replace the old bridge recently burned.

Baltimore, Md.—The Anne Arundel county commissioners have awarded the contract for the iron bridge across the Patuxent river at Laurel to the Groton Bridge Co., of Groton, N. Y., for $1,900.

Riverview, W. Va.—A 3-span iron bridge has been built across the New river for the Chesapeake & Ohio, by the Phœnix Bridge Co.; the spans are 300 ft., 250 ft. and 200 ft.

Jeffersonville, Ky.—The Champion Bridge Co., of Wilmington, O., has the contract for an iron bridge of 120 ft. span across Slate creek.

Tyrone, Ky.—Work is in progress on the masonry of the Louisville Southern bridge over the Kentucky river. Some of the iron work is on the ground.

Bainbridge, Ga.—Plans and specifications have been prepared for the Flint river bridge of the Alabama Midland Ry.

Columbus, O.—The County Commissioners will build a new bridge over the Scioto river at Rich St. They have also approved plans for a bridge over the Olentangy at Third Ave.

St. Paul, Minn.—The people of the West Side have petitioned the Council to build a low level bridge across the river from Broadway to State St. E. YANNISH and HOWARD L. SMITH are interested.

Kingsboro, Wash. Ty.—The New Westminster Southern & Bellingham Bay Ry. Co. will build a swing bridge across the Nooksack river.

Winnipeg, Manitoba.—The Northern Pacific & Manitoba Ry. bridge is progressing rapidly. The first span is completed and the draw is under way. Kelly Bros. built the pivot pier for the draw.

Bridge Abutments.—The following proposals for the Leyden St. bridge abutments were opened March 16 by the City Engineer: Trumbull & Cheney, Boston, $11,990; D. Henry Crane, Boston, $12,799; John A. Leavitt, Boston, $13,550; Thomas A. Rowe, Boston, $14,987; Moulton & O'Mahoney, Boston, $15,695; Hugh Nawn, Boston, $18,375 C. W. Parker, Boston, $20,697; Wm. H. Ward, Lowell, $21,253. The contract was awarded to Trumbull & Cheney.

Canals.—On March 25, the Delaware & Hudson canal was opened for navigation, more than two weeks earlier than last year.

ELECTRICAL.

St. Louis, Mo.—The following were the proposals received by the Board of Public Improvements for lighting the city by electricity during 1889. The prices given are for each light per annum. One other bid was received, from the Heisler Co., but it was informal:

	Thomson-Houston	*Laclede Gas Light Co.*	*Chas. A. Brown, Chicago*	*Chas. Sutter*	*Missouri Electric Light & Power Co.*
Arc lamps of 2,000 c. p. for streets	$115.00	$109.50	$99.00	$74.95	$94.75
Arc lamps of 2,000 c. p. for parks	42.00	40.00	29.00	39.90	80.00
Arc lamps of 2,000 c. p. for public buildings	78.00	76.92	54.00	51.25	94.75
Incandescent lamps of 30 c. p. for streets	20.00	19.95	17.50	28.20	26.00
Incandescent lamps of 30 c. p. for parks	6.00	5.00	3.37	17.00	20.00
Incandescent lamps of 16 c. p. for public buildings rated as class 1 of specifications	30.00	27.00	20.00	14.90	9.50
Incandescent lamps of 16 c. p. for publicbuilings rated as class 2 of specifications	9.00	8.75	6.02	13.00	7.00

Electric Light.—***Topsham, Me.***—The town has voted n favor of introducing electric light.

Lockport, N. Y.—The gas company has refused to take the electric light contract for 2 years at the terms for a 3 years' contract.

Harrison, N. J.—The Harrison Electric Light Co. having failed to carry out its contract, other propositions have been received by the Council.

Stroudsburg, Pa.—The electric light company has been organized, with a capital stock of $15,000, and will establish its plant at once.

Delphos, O.—The Silvey Electric Light Co., of Lima, O., will put in a plant for this city.

Anniston, Ala.—The Thomson-Houston Co. has bought the Anniston City Land Co.'s electric light plant, and will extend it. A contract has been made with the city.

Red Jacket, Mich.—The Peninsula Electric Light & Power Co., of Houghton, will put in an electric light plant.

Fargo, Dak.—The Fargo Gas & Electric Co. has been organized by a consolidation of the gas and electric light companies. Capital stock, $250,000. President, S. V. STONE; Secretary, S. NEWMAN.

Walsenburg, Col.—The plans are in preparation for an electric light plant.

WATER AND MUNICIPAL.

Flushing, N. Y.—Col. G. A. ROULLIER, the Superintendent of the Water-Works, is in favor of the project to introduce water meters to prevent waste and equalize the rate of taxation. Two years ago, before the introduction of the first meters, a pressure of 45 lbs. in warm weather, or 35 lbs. in winter, could not be maintained. When the first 100 meters were put in, a pressure of 50 lbs. could be maintained, and now, with 225 meters in operation, the pressure is 55 lbs. A larger main than the present one of 12 ins. diameter is needed, but it would cost $25,000 or $30,000.

Seattle, Wash. Ty.—Col. GEO. E. WARING, of Newport, R. I., has made a report upon a sewer system for Seattle, and recommends the small pipe separate system, similar to that put in by him at Memphis, Tenn., and San Diego, Cal. The outlet is to be in the harbor in 40 ft. of water. The total length will be 35.4 miles of pipe, and the total cost of construction, according to the plans and specifications submitted, is $284,063.63. The smallest main pipe is to be 6 ins. diameter with 4-in. house connections.

The American Water Works & Guarantee Co. has been incorporated at Pittsburg, Pa., and its works will be at McKeesport, Pa. Capital stock, $500,000. President, DAVID W. HITCHCOCK; Secretary and Treasurer, JAMES S. KUHN.

Manchester, N. H.—The Water Commissioners have presented their report for 1888. The hydrant rental has been reduced from $50 to $40 per annum, the original rate having been $60. The total pumpage was 667,800,700 gallons, but there was a very large amount of waste during the cold season. There were 11,351 ft. of pipe laid, and 959 ft. relaid; at 22 places breaks occurred and cement pipe was replaced with cast-iron; 8 hydrants and 26 gates were set. There are now 26.773 miles of cement lined pipe, 24.791 miles of cast-iron pipe; 391 gates, 426 hydrants, 7 air-valves and 842 meters. CHARLES K. WALKER is Superintendent.

Carlyle, Ill.—(March 14.)—In the spring of 1887, the City Council of Carlyle closed a contract with a syndicate of St. Louis to build a system of water works for this city. The company contracted to put in about 3½ miles of mains, and about 70 fire-plugs, stand-pipe 115 ft. high, engine house, etc. The annual rental to be paid by the city was $2,100. The plant was completed in September 1887, but was rejected by the City Council, who claimed that water was not forced to the required height at all points as mentioned in the specifications. Upon refusal to make the first payment on the rental, the contractors instituted suit in the Circuit Court of this (Clinton) county in May, 1888. Eminent counsel was employed by both parties in the controversy. The case was decided against the contractors, in the Circuit Court. They at once took an appeal to the Appellate Court, where the case has been pending until to-day, when a telegram was received which stated that the decision of the Circuit Court had been reversed, and the case remanded. No doubt the city will continue to fight the case unless a compromise can be effected, as the citizens in general think $2,100 annual rental too extravagant an expenditure. St. Louis (Mo.) *Globe Democrat.*

Sandusky, O.—The Water-Works Trustees have issued their report for 1888. During the year a new Worthington engine has been purchased; 8,493 ft. of mains were laid, 19 hydrants and 15 gates set. There are now 26¼ miles of pipe, 181 hydrants, 178 gates and 1,692 taps. The total consumption was 764,800,000 galls., an increase of 19.2 per cent. over 1887; a considerable amount of this is considered to be waste, and the Superintendent suggests that $1,500 be appropriated to purchase meters, with a view of eventually metering all consumers, except perhaps private houses. It is also recommended that steps be taken to improve the supply, either by the use of a filter plant or otherwise. CHAS. A. JUDSON is Superintendent.

Water-Works.—***Maine.***—Westbrook. The Portland Water Co has made a proposition to lay pipes and furnish a water supply.

Massachusetts.—Stockbridge. CHAS. H. WILLIS and others propose to organize a new water company to furnish a supply from Mohawk lake.

Connecticut.—Manchester. The contract for pipe laying has been let to the Connecticut Patent Water Pipe Co. of New Haven.

New York.—Avoca. The new water-works will soon be commenced and it is expected they will be completed by September.——Syracuse. The Syracuse Water Co. is securing land in the Onondaga valley, where the gang wells are.——Sing Sing. Water has been turned into the pipes.——Lansingburg. Work will be resumed shortly on the new reservoir.

Pennsylvania.—Bethlehem. The Water Committee has been authorized to build an additional reservoir of 900,000 galls. capacity and to put in a pumping engine of 2,000,000 galls. capacity.——Pittsburg. The laying of the new water main will cost $100,000.——Reading. Trenching for the new Maiden creek supply has been started by Yarnell & Tyson, the contractors. The Water Board has awarded the contract for the pumps for the new works to H. R. Worthington, of New York, at $17,000.——Lancaster. The new water-works erected by the city on the Conestoga creek, above the source of sew tion, were dedicated March 28. There are two Worthington pumps of 11,000,000 galls. daily capacity, and the present consumption is about 5,000,000 galls. daily.

West Virginia.—Terra Alta. Water-works are to be put in; the water will be pumped by a windmill pump to a tank of 4,000 galls. capacity.

South Carolina.—Orangeburg. Mr. Cornelson has purchased the water-works and will extend the distribution system, putting in 20 hydrants per mile. The city will pay $2,000 per year. The works will cost about $30,000.

Mississippi.—Natchez. J. A. JONES, the contractor, is at work on the pipe laying, and will have this done by June.——Vicksburg. The city has accepted the water-works plant.

Kentucky.—Georgetown. A Cincinnati syndicate has made a proposition to the Trustees to put in water-works, with 40 hydrants, for $1,500 per year.——Richmond. The water question is being discussed; the present company has, as yet, taken no action under its franchise.

Ohio.—Bucyrus. A suit over the franchise is said to be pending between the city and the water company.——Upper Sandusky. James Langley & Co., of Newark, N. J., have made a proposition to put in water-works with 100 hydrants at $3,400 annual rental. Moffett, Hodgkins & Clarke, of Watertown, N. Y., have also made a proposition, for 90 hydrants at $4,000.

Michigan.—Sturgis. Water-works are projected and steps will probably be taken soon to establish them.

Illinois.—Fort Sheridan. Proposals for putting in the water-works will be opened April 22 by CROSBY P MILLER, Asst. Quartermaster, U. S. A., Highland, Park, Ill.——Carlinville. Ground has been broken for the foundations of the water tower in the market square. Locations for the pumping station and pipe line have been established and several contracts let.

Kansas.—Richfield. The water-works bonds have been placed and work will be commenced at once.

Nebraska.—Arapahoe. Water-works are projected; the supply will be taken from the river or creek.——Madison. Water-works will be built this season; there will be 4, 6 and 8-in mains, 20 hydrants, 22 gates and a stand-pipe of 50,000 galls. capacity. Population, 1,000. The plans and specifications were prepared by GEO. A. LATIMER C. E., of Norfolk, Neb.

Colorado.—Las Animas. The engine house for the city works is about completed, trenching is in progress and the well is down 15 ft.——Pueblo. As soon as the new names of the South Pueblo Water Co. are completed new and larger laterals will be put in. When these improvements are completed, the capacity of the works will be increased fourfold.——Denver. The Citizens' Water Co., with a capital stock of $3,000,000, was organized March 30 to build a water system capable of supplying a city of 500,000 inhabitants.——Manitou Springs. The city is opposing the right of Colorado Springs to lay an additional 16-in. main through the streets.

Oregon.—Roseburg. The Roseburg Water Co. has been incorporated by R. R. SHERIDAN, W. S. HAMILTON, O. L. WILLIS, and others, capital stock $100,000. The works have been completed at a cost of $20,000.

Washington Territory.—Montesano. A water supply is to be brought to the city from Sylvia creek, 2½ miles distant, through a 5-in. main.——Centralia. The Centralia Water Co. has been incorporated by T. H. BARNUM, E. B. BUTTERWORTH, J. B. LANDRUM and others. Capital stock, $25,000.——Vancouver. The water-works on the military reservation are nearly completed.

California.—Petaluma. The Petaluma Water Co. will improve its works.——Los Gatos. Water works of 50,000 galls. daily capacity will be built by B. P. RANKIN and T. GIPSON.

Utah.—Salt Lake City. The Council has adopted a resolution to employ two experts to investigate and report upon the water supply question.

Canada.—Wiarton, Ont. Hardy & Leathorn, of London, will probably have the contract for the water-works extension, at $4,400.——Vancouver, B. C. On March 26 the water from Capilano river, across Burrard inlet, reached the city through the pipes of the Vancouver Water-Works Co. across the mouth of the harbor.